No. 1857 Vol. XLVI

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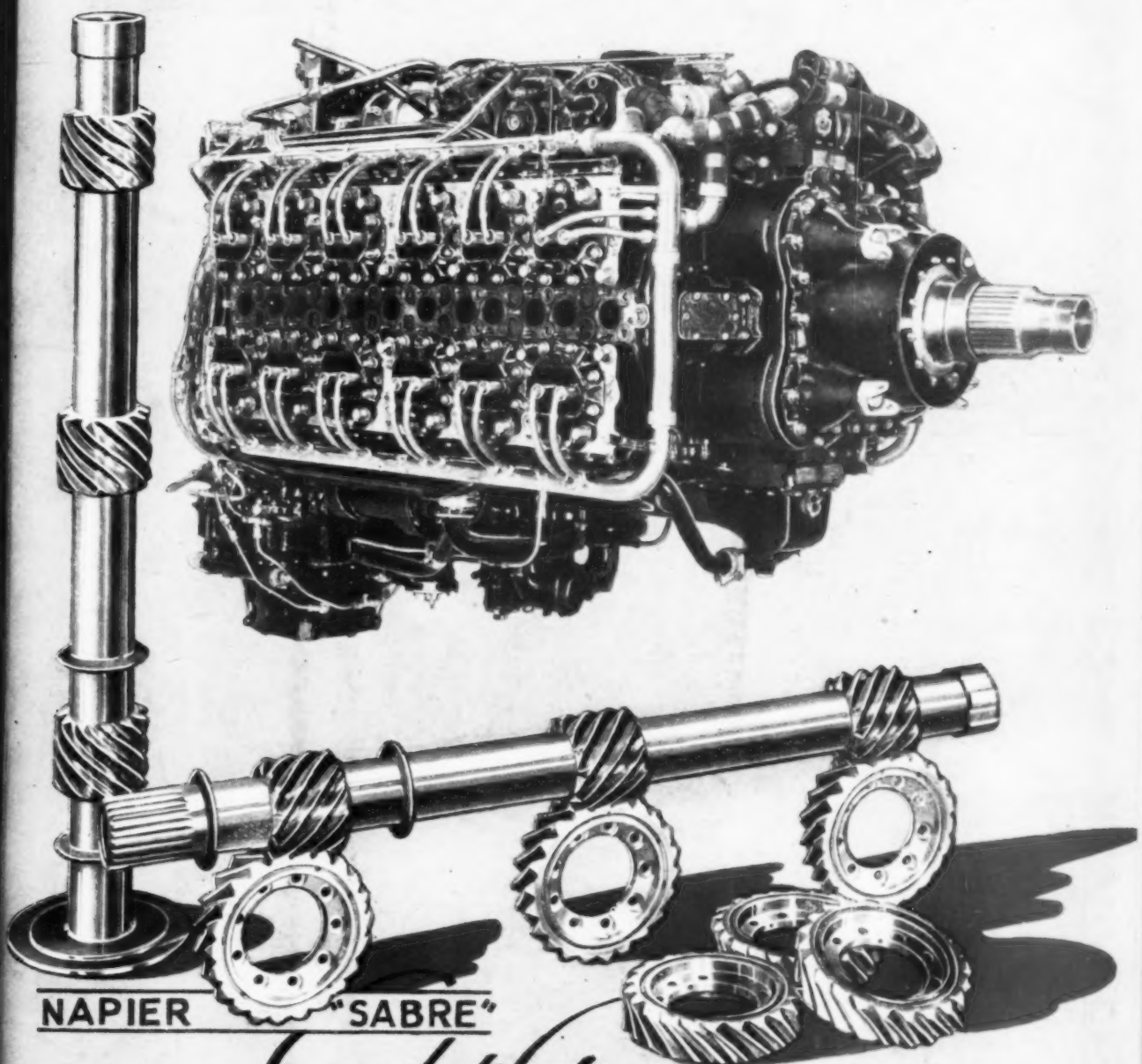

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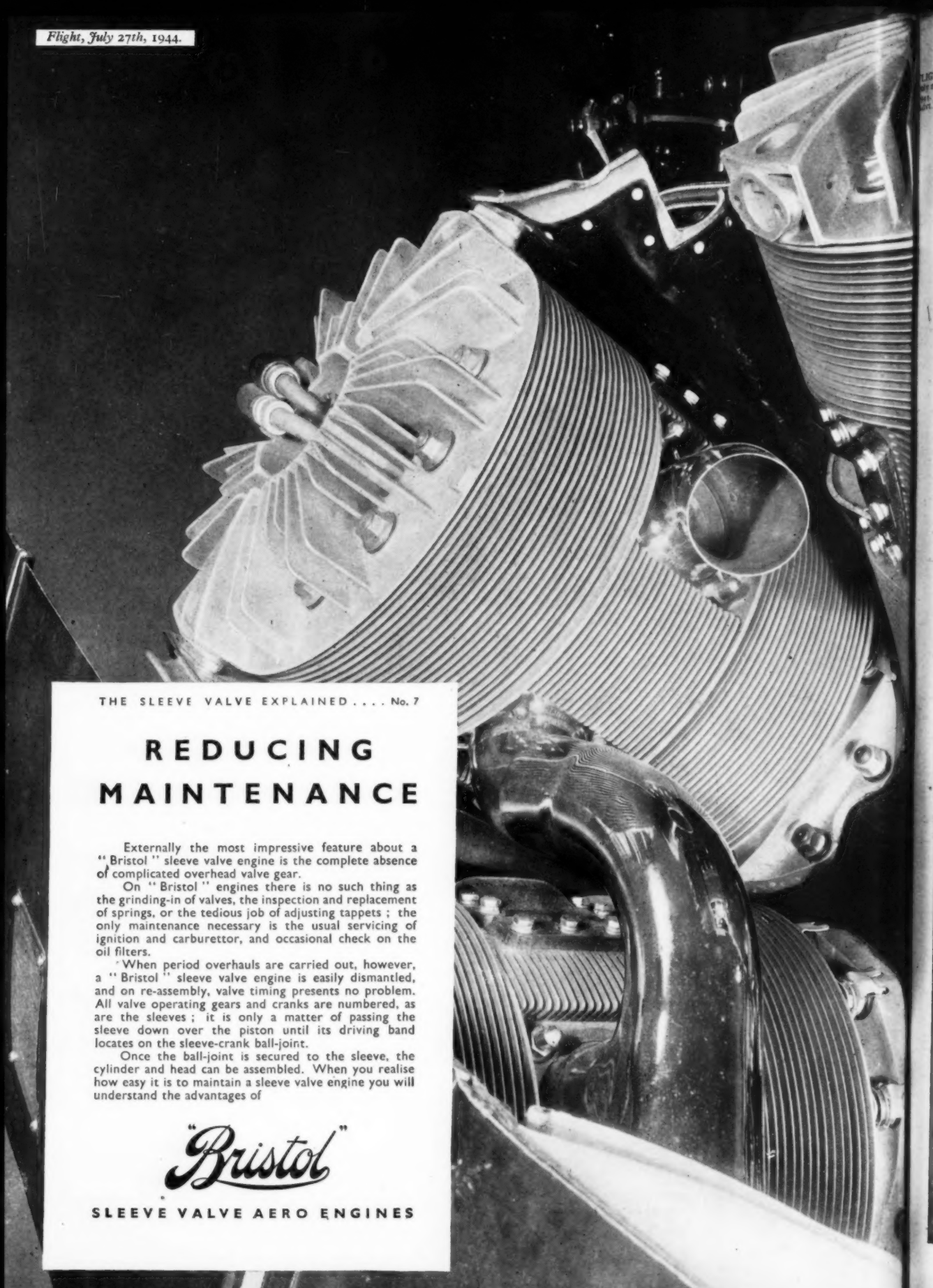

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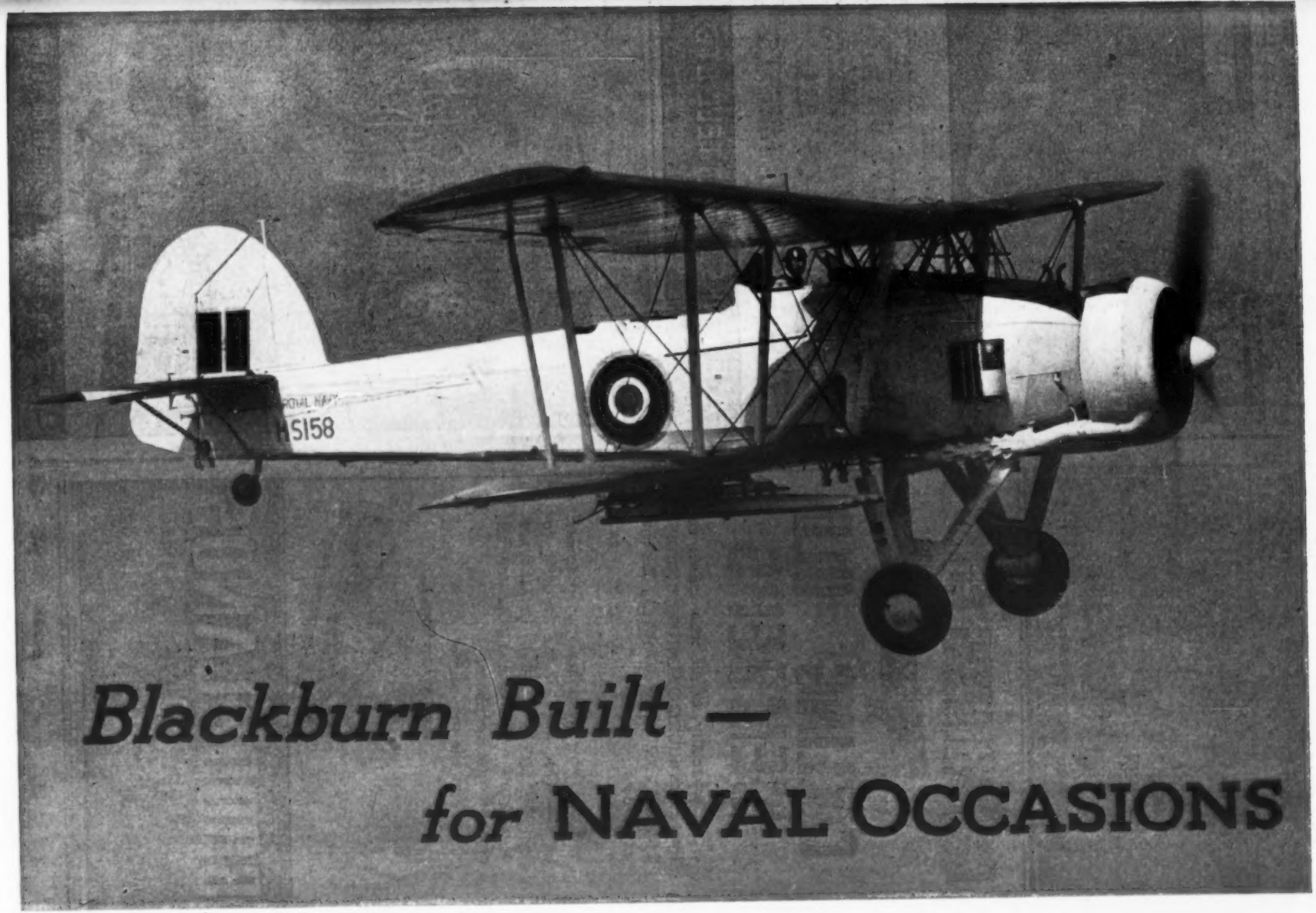

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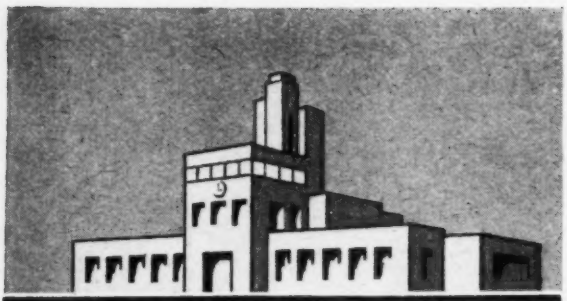

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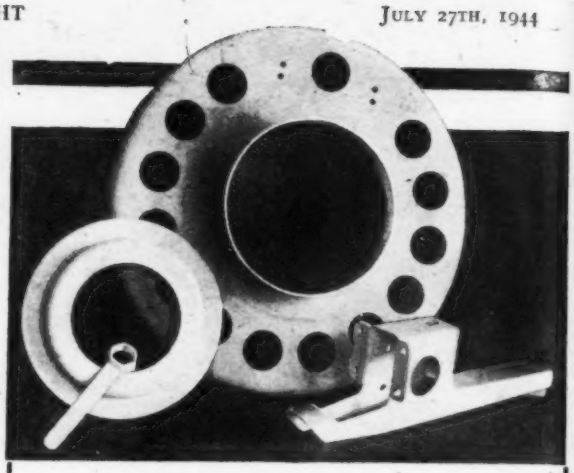

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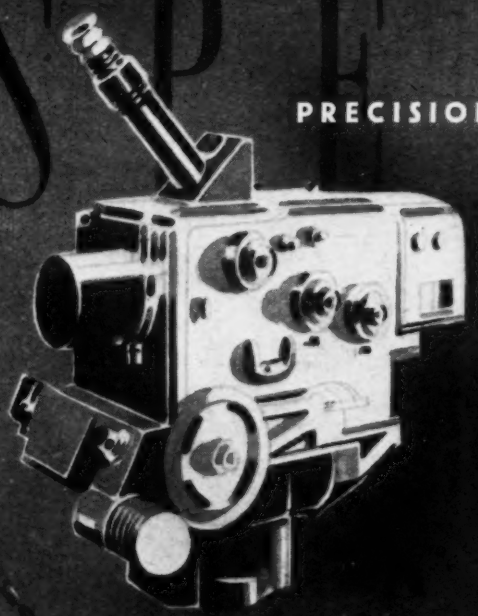

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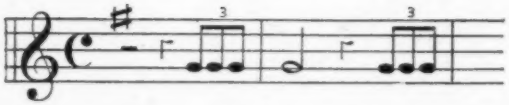

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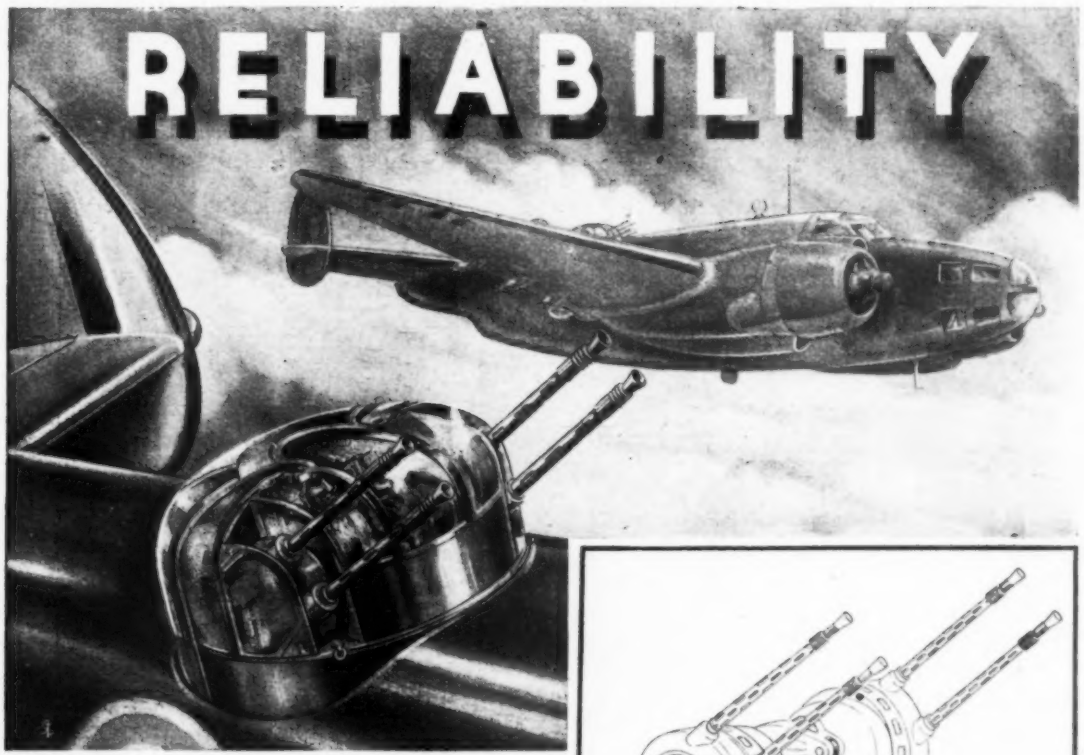

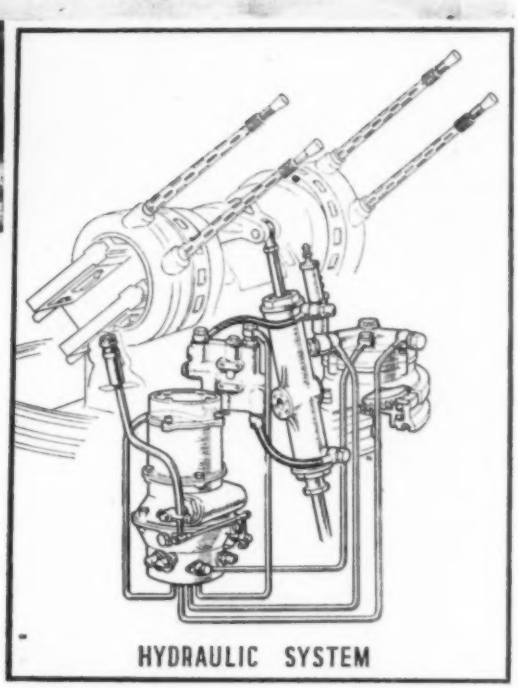

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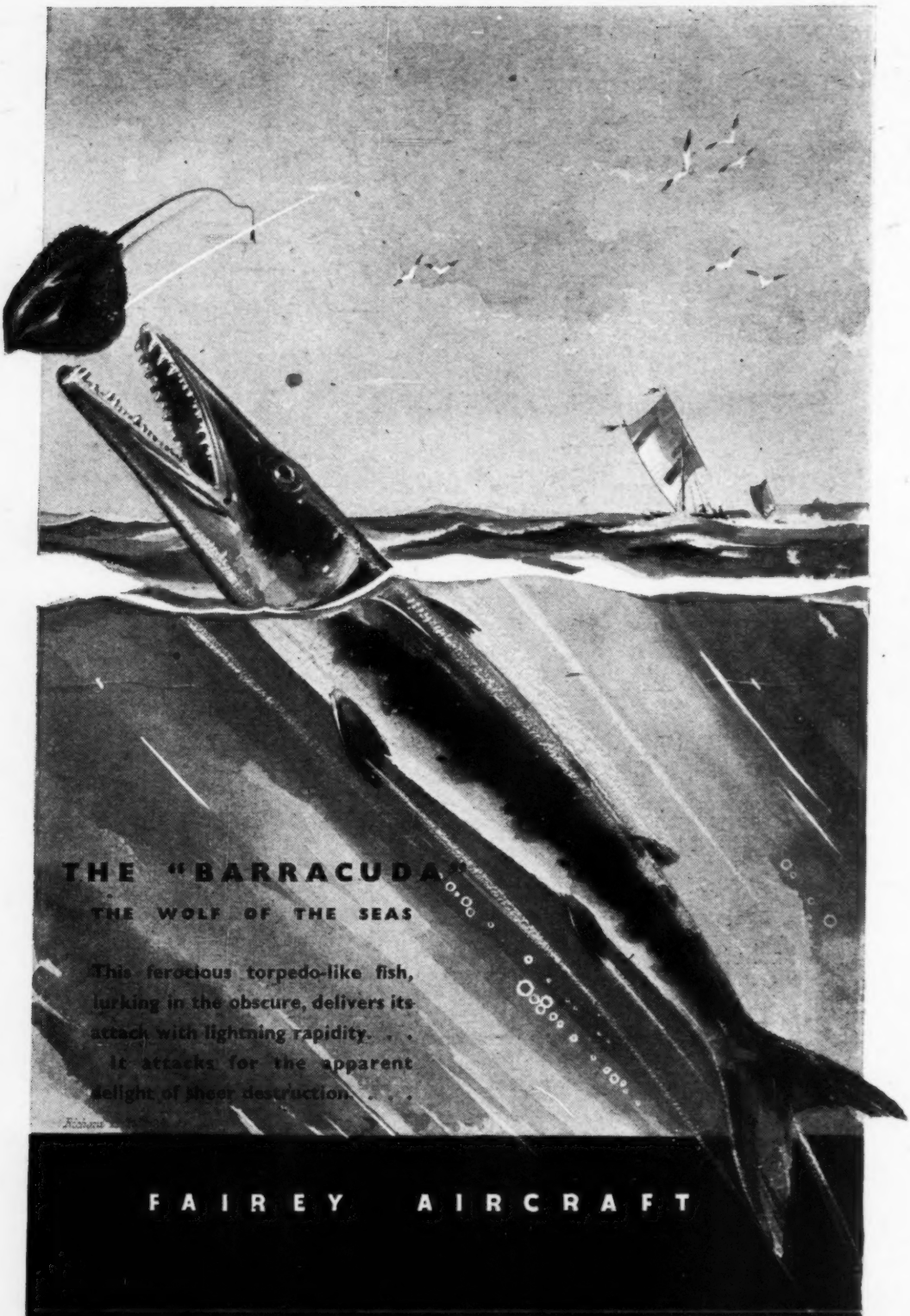
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G. GEOFFREY SMITH, M.B.E.

Chief Photographer
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Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1
Telegrams: Truditur, Sedist, London. Telephone: Waterloo 3333 (35 lines).

COVENTRY: 8-10, CORPORATION ST. Telegrams: Autocar, Coventry. Telephone: Coventry 5210.
BIRMINGHAM, 2: GUILDHALL BUILDINGS, NAVIGATION ST. Telegrams: Autopress, Birmingham. Telephone: Midland 2971 (5 lines).
MANCHESTER, 3: 260, DEANSGATE. Telegrams: Iliffe, Manchester. Telephone: Blackfriars 4412.
GLASGOW, C.2: 26B, RENFIELD ST. Telegrams: Iliffe, Glasgow. Telephone: Central 4857.

Registered at the G.P.O. as a Newspaper.

No. 1857. Vol. XLVI. July 27th, 1944 Thursdays, One Shilling.

The Outlook

The Tactics of Fusing

EVERYONE will remember the excitement caused in this country when it was announced that, for the first time, Bomber Command had sent no fewer than 1,000 aircraft in one night to bomb Cologne. The result on public opinion was not all good; for people began to murmur when 1,000 machine raids did not follow each other in quick succession.

Now, such concentrations of bombers, always carrying a far heavier weight of bombs than fell on Cologne on that first night, are accepted as all part of the day's work. But a raid by 1,000 Lancasters and Halifaxes in daylight, as part of the preliminary bombardment before an advance by the Army, is a new thing, and was never foreseen by the prophets. It was one of the many spectacular features of General Montgomery's break-through from the Normandy beach-head into new country last week. The only signs of attempted interference by the *Luftwaffe* were promptly dealt with by American fighters.

Attacking troops are nearly always surprised to find what considerable elements of the defence have escaped a bombardment (whether by bomb or by shell) when they begin to advance. The senior officers, however, have seen the same thing happen before, and on this occasion they took steps accordingly. The cleverest feature of the air part in the advance was the use of different types of fuses in the bombs, designed to hamper the movements of the enemy in some places and to leave country open for the advance of our troops in others. Where it was intended to obstruct the enemy, bombs with slightly delayed-action fuses dug deep into the earth, and then blew out large craters as they exploded. Where it was meant that our men should press forward without meeting obstructions, the bombs were fused to explode on the surface. There they did the maximum damage to the German troops without cratering the ground.

The study of combined work between air and ground has certainly advanced very far since the days of the Air Component and the A.A.S.F. in France in 1940. Now, as a Roman poet once wrote, *mens agitat molem*, which may be freely translated, "there are brains behind the power."

Superfluity in the Air

WHEN in 1918 it was proposed to establish the Independent Air Force, the view of the British Government was stated to be that, once the necessities of the Army had been determined and allowed for, the balance of aircraft resources should be devoted to bombing squadrons. This stung the French representative, General Duval, to retort that he would be grateful to anyone who could establish the limit of what was necessary to a battle.

Now, it seems, that what was thought in 1918 to be beyond the limits of probability has actually come to pass. Thanks to the Empire Training Scheme, to the grand output of British aircraft factories, and to the wonderful assistance of the United States, the Allies have actually reached a point beyond which the expansion of their Air Forces is held to be unnecessary. The needs of the Army and also of Bomber Command have been provided for, and a sufficient margin is left over.

In the issue of *Flight*, dated July 6th, it was recorded that recruitment for the Royal Canadian Air Force had been suspended, as there were already more aircrews than were likely to be needed. Pilots already under training would receive additional instruction.

Following on that decision, it has now been announced

that men are actually to be transferred from the Royal Air Force (and also from the Royal Navy) to the Army, where they will be able to be of more use to the Allied cause than if they remained in their original Service. Who, in 1939, could have foreseen that British air power would in five years have reached a point of superfluity?

The main features of this new scheme are summarised on another page of this issue. It should be noted that recruiting for the R.A.F. and for the A.T.C. is not to stop altogether, but the numbers accepted for aircrew duties will be reduced, and a standard even higher than that which has always prevailed will govern the future selection of candidates for aircrews. This continued recruiting is, of course, necessary to replace casualties and normal wastage.

We sympathise with those young men who had hoped to become members of aircrews and will now be disappointed; but they will have another chance of joining the R.A.F. after they have completed their service in the Army. There is, we feel assured, no danger that when Germany and Japan have been defeated, the R.A.F. will be again reduced in the foolishly improvident way followed in 1919.

The Stars in Their Courses

IT makes one envious to read about blazing heat on battle fronts in parts of Russia, while in Normandy the British and American troops are slithering about in deep mud. Low clouds over the Channel prevent the fighters of A.D.G.B. from seeing numbers of the air torpedoes, which, if they could be spotted in time, would nearly always be shot down. At the time of the Dunkerque evacuation the weather gave all possible help to the United Nations; and at no time in the war has weather had a more decisive effect than then. Its change of mood four years later delays Allied progress, but will have no effect on the ultimate course of the war. Bad weather at the time of Dunkerque might have been disastrous.

The ground troops suffer in the wet, and the tanks and other vehicles can make little progress, just at a time when a quick advance is a thing much to be desired. The air arm is naturally most hampered by bad weather and low clouds. This is unfortunate when the Allies have complete ascendancy in the air, and might have counted on gaining much profit from it. Our aircraft had previously played such havoc with the railways and roads which the Germans had hoped to use, that their movements of reinforcements and munitions had in any case become very difficult; and, of course, the rain has still further increased those difficulties.

When nature imposes a common infliction on two struggling sides, the stronger of the two must be the greater loser. The Allies are certainly the stronger side in Normandy, and therefore have the greater cause to regret restrictions of movement. If the weather would only clear (and it may do so, perhaps even before these words are published) our aircraft could still make movement difficult for the Germans, and could also attack their strong posts. The nature of the country offers a good deal of protection to the enemy from our direct air attacks; but if his reserves were immobilised, while our men were not so hampered, progress would soon be accelerated.

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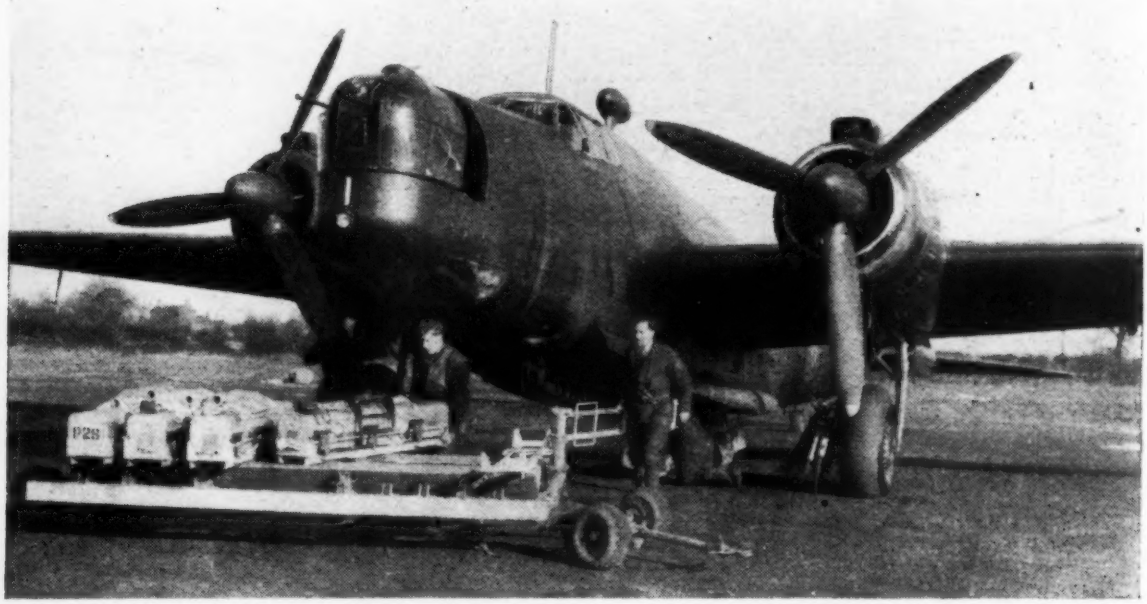
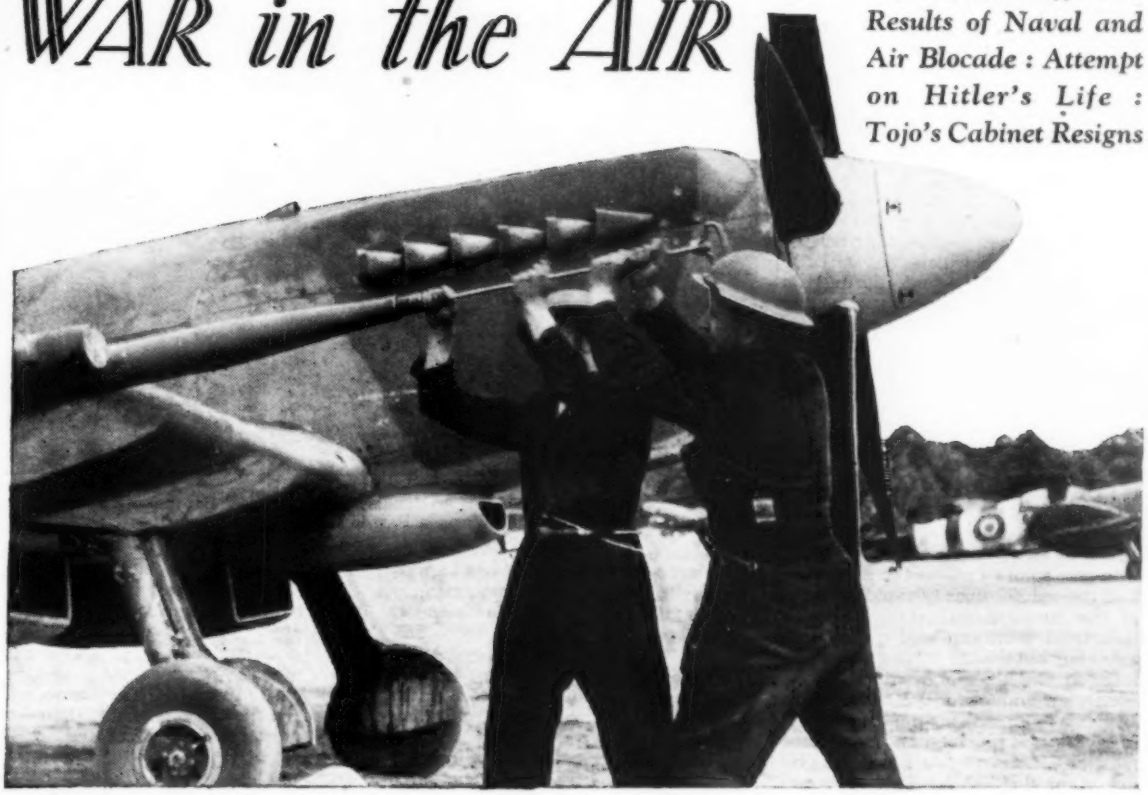


FIRING THE ENEMY'S IMAGINATION: Apart from all the splendid work done by the Vickers Wellington for both Bomber and Coastal Commands, it is still used for leaflet raids. The leaflets are carried in incendiary-bomb cases.

WAR in the AIR

"A Decisive Effect": Results of Naval and Air Blocade: Attempt on Hitler's Life: Tojo's Cabinet Resigns



DOODLE DOWNER: Cleaning the cannon of a Rolls-Royce Griffon-engined Spitfire of A.D.G.B. before going on an air-torpedo patrol.

IN these days of combined operations polite messages of thanks from one Service to another are common and usual. There is, however, something especially emphatic and telling in the message which Gen. Montgomery sent to Air Chief Marshal Sir Trafford Leigh-Mallory after the break-through by the 2nd Army to the south of Caen. "The tremendous weight of air attack," wrote the General, "inspired the troops and had a decisive effect." "Decisive" is a very strong word to use, and Gen. Montgomery has a reputation for not using words lightly. One knows that soldiers like very much to see their own aircraft in action, and when (as at Dunkerque) the aircraft have to fight beyond the range of the soldiers' eyes, the men on the ground are inclined to grumble. But the preliminary bombing of Caen would certainly cheer up the spirits of those who were about to advance against the German positions. They knew they would find less opposition.

For days after the attack war correspondents who had witnessed the bombing continued to rave about it, telling over and over again how first over 1,000 R.A.F. heavies poured down destruction on the Mondeville steel works, which had proved such a thorn in the flesh of the Army; how then American heavies, 600 or more in number, pounded targets farther off; and finally how Marauders and Havocs cleared a path for the British and Canadian advance with fragmentation bombs. In less than four hours between 7,000 and 8,000 tons of bombs were dropped on the Germans. When the aircraft had finished, the artillery took up the work, while more distant targets were shelled by the guns of the Navy. But even during the bombing our guns were not idle, and the little Piper Cub spotter aircraft took the risk of being hit by our own bombs as they flew over the targets and observed for their own batteries.

The artillery is now using vast quantities of shells, all of which have to be transported into Normandy by ships. Among the advantages of using bombers to hit the enemy positions is the fact that they bring their own explosives with them. In fact, they substitute air transport for sea transport, and this

AIR SALVO: Twenty-six 100 lb. bombs fall in a string from a U.S. Army 9th A.F. over France.

WAR IN THE AIR

must be a relief to the strain on the shipping situation.

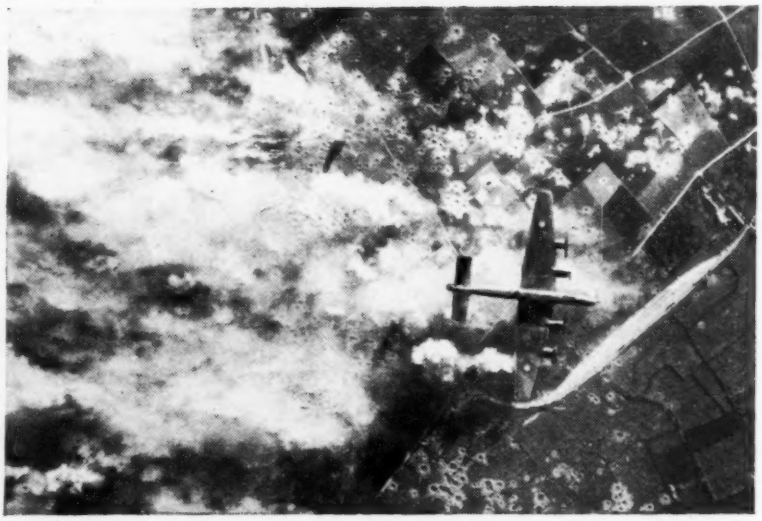
In the first month of the invasion some 158,000 sorties were flown by Allied aircraft, despite the unfavourable weather. No fewer than 1,067 enemy aircraft were destroyed in the air, which must be a high percentage of those engaged. Our own losses were 1,284 machines, which was slightly more than one per cent. during the initial phase. The proportion of losses has since been reduced.

The loss of Leghorn (we almost feel inclined to omit the "h" from the word, so as to correct the extraordinary pronunciation which the B.B.C. has invented for the name of that place) and Ancona simultaneously probably came as no great shock to the German High Command, as they must have expected to lose both before long. Still, when these captures are added to Montgomery's break-through into new country across the river Orne and the extraordinarily rapid advance of the Russians on many sectors of their front, there can hardly have been anything but gloom in the operations room at Hitler's headquarters.

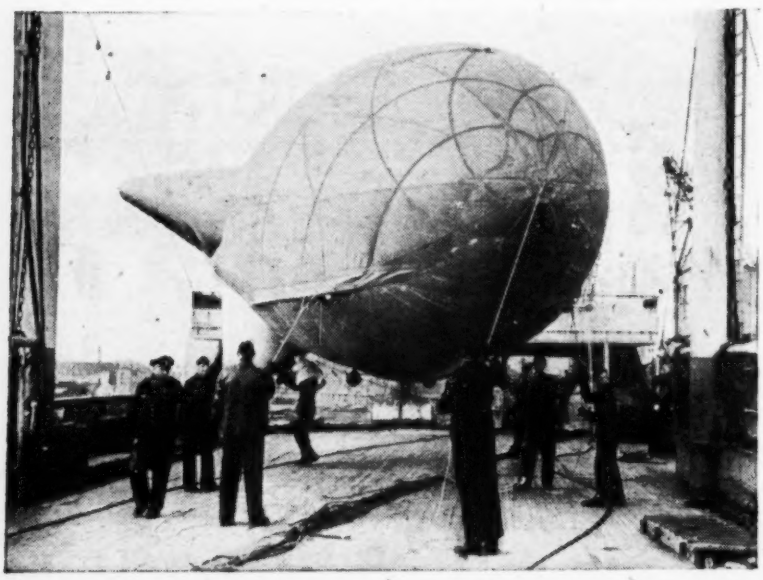
German propaganda is paying the British and Americans the compliment of saying that the Western Front is the most important one, and that the giving of ground in the East does not really matter. The inhabitants of East Prussia, the darling nursery of the Prussian race, probably do not quite share that view. One remembers that it was the Russian threat to East Prussia in 1914 which drew off Hindenburg and his forces (to win the crushing victory of Tannenberg) and so made possible the Allied victory of the Marne—a victory far more important in its results than Tannenberg.

General Eisenhower has been at pains to explain that there is no competition between the three Allied fronts, and no claim that one is more important than the others. All are hitting the Germans and defeating them.

The naval blockade and the bomber offensive have been doing the same thing; though it always takes longer to see the results of those forms of warfare than to appraise the results of a victorious land battle. Lord Selborne, Minister of Economic Warfare, in a speech last week, was able to announce some of the results of the blockade and the bombing which are now becoming apparent. The supplies of ammunition for practice shoots had been cut down, German aircraft tyres were now made entirely of synthetic rubber, the supplies of oil to the fighting fronts had been reduced, and, above all, there was the great shortage of German fighter aircraft. The harder we can make the Germans fight, the more such shortages will affect the battle fronts.



NIGHT BOMBER BY DAY: A Handley Page Halifax III making a daylight attack on a Pas de Calais target.



ANTI-BEAUFIGHTER: The towed kite balloon on a German minesweeper.

The Shadow Before

ALTHOUGH political events in the Axis countries have no direct connection with the air side of the war, no attempt to give a picture of the war week by week could afford to disregard two such happenings as the attempt on Hitler's life and the resignation of Tojo's Cabinet in Japan. Both indicate lack of confidence in the direction of the war; and in bringing about that lack of confidence the air weapon has surely played its part.

One result of the attempt on Hitler's life is sure to be an outburst of renewed affection for him as Führer. Political assassination, when it fails, almost invariably has that effect. Hitler has a hypnotic hold on the sentiments of the German people; and thankfulness for the survival of the popular idol may well distract minds from their present sufferings and their gloomy forebodings about the inevitable future.

For very different reasons the United Nations may rejoice that Hitler escaped death at the present juncture. He has made himself Commander-in-Chief of all the German armed forces, and his military mistakes have brought disaster after disaster on his country. The one section of the German people which has not been bewitched by him has been the trained Generals of the Army. Many of the ablest of them have been dismissed, presumably because they

WAR IN THE AIR

refused to let their trained military intellects bow before Hitler's intuitions. The anti-Führer movement seems to have been widespread among professional officers. It is legitimate to conclude that if the plot had succeeded the military affairs of Germany might have fallen once more into the hands of trained and able Generals.

Things have now reached such a point that no military genius could bring back to Germany the prospect of victory over the United Nations; but the removal of Hitler might have prevented the commission of more military blunders, and to that extent might have delayed the victory which Eisenhower, Stalin and Alexander are now on the point of achieving.

Tojo Likewise

FROM this distance it is not possible to estimate clearly all the facts about Tojo's disappearance from power; but certainly his military leadership has brought Japan to the brink of ruin, and she will be pushed over that brink just so soon as the Western Powers have done with Germany.

It was announced the other day that the Emperor Hirohito was "much concerned" by the situation, and when that absolute autocrat is disturbed, his advisers and Ministers are sure to feel the results of his perturbation. Tojo had lost the absolute command of the seas, which Japan once held in the Pacific, and he has frittered away the Japanese Air Force until it now counts for very little.

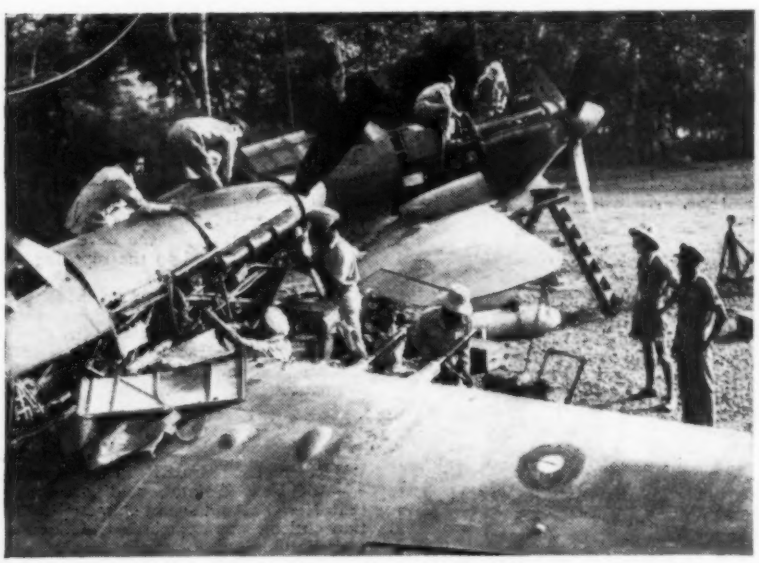
Of course, his cardinal error was to attack the Americans at Pearl Harbour under the erroneous impression that they and the British were down and out, and that everything was clear for Japan to establish an Empire over all Asia, and perhaps beyond. For that criminal mistake there is no excuse, and from its inevitable results there is no escape.

FOR LOW STRAFING: Re-arming a Typhoon in Normandy with rocket projectiles.

Disturbed Communications

TO the newspaper reader in Great Britain nothing has yet brought home such a realisation of the work which the Allied Air Forces have done in disorganising the communications of France as the delay in getting three trainloads of internees through to Lisbon, where an equal number of German internees was waiting to be exchanged. The journey took a fortnight, and on the way the trains were bombed and machine-gunned by Allied aircraft. Naturally the aircrews did not know that their targets were full of friends and countrymen. Several times the passengers had to leave the trains and scatter across the fields to avoid the attacks, while interruptions on the lines caused many diversions and delays. One wonders how the German internees will enjoy their journey back to the Fatherland!

Coastal Command had a record day out last week, when it intercepted an unusually large enemy convoy, with a very strong surface escort, off the coast of Heligoland. The guns, shells, and rockets of the Coastal aircraft wrought great havoc, and not a single ship escaped without damage. Someone, perhaps Rommel, is going to be badly disappointed by the non-arrival of the cargoes of those ships.



STILL GOING STRONG: Hawker Hurricanes operated on the Burma front by the Indian Air Force.

Guam Island

THE American capture of Saipan Island in the large Mariana group was admitted by the Japanese to be a disaster; and it may have been the cause of the fall of Tojo. Admiral Nimitz never rests long on one wreath of laurels; he is quick to follow up and strike again. Guam Island in the same group, but to the south of Saipan, was the next place to be invaded; and as is now usual, the American landing was preceded by a long bombardment by aircraft from the carriers and the guns of the warships. The Americans have been steadily fighting their way forward against stiff resistance. The time is now surely not distant when Britain and the United States will be able to bring their full strength against Japan.

HERE AND THERE

"BUTTONED UP": A swimming pool in the grounds of a country house provides dinghy drill for R.A.F. fighter pilots in Southern England.

New R-R. Chairman

CAPTAIN E. C. ERIC SMITH has been elected chairman of the Rolls-Royce board of directors in succession to the late Lt. Col. Lord Herbert Scott.

He is also deputy chairman of the National Provincial Bank and a director of a number of other companies.

R.Ae.C. Staff Holiday

IN order to give the staff a short holiday, the Royal Aero Club in Piccadilly will be closed for nine days from August 5th to 13th inclusive.

Members sleeping at the club during this period will still be served with breakfast, but no other meals, and no drinks, will be obtainable.

Miss M. Chadwick Married

MISS MARGARET CHADWICK, daughter of Mr. Roy Chadwick, the Avro designer, was married recently to Radio Officer John E. Dove, at St. Ann's, Manchester. Many well-known Cheshire people attended the ceremony and the reception which followed at the Midland Hotel, Manchester.

Air League's Treasurer

MR. J. ARTHUR RANK, best known as one of the leading personalities in the British film industry to-day, accepted the invitation of the executive council of the Air League of the British Empire to become its honorary treasurer, and was duly elected at the league's annual general meeting last week.

The business of the meeting was confined to the election of officers and similar purely domestic matters.

Still Being "Studied"

MR. CHURCHILL told Mr. Granville (Ind., Eye) in the Commons recently that he had no statement to make about the date or place of the coming international conference on civil aviation.

Mr. Granville asked for an assurance that plans for British post-war civil aviation would not be held up pending decisions reached at the conference, and asked if Mr. Churchill could suggest a date and say whether the conference would be in this country.

Mr. Churchill: "I cannot govern the latter part of this question because other people will have to come to the conference and they would have views of their own. It does not really rest with H.M. Government, but the whole question is being continually studied."

Can Anyone Oblige?

HAS any reader a copy of *Flight* dated March 4th and/or April 8th, 1943, with which he would be prepared to part? The Manufacturers Aircraft Association, New York, requires them to complete its file, and would be glad to meet "any reasonable charge" to obtain these copies, which are out of print.

"Out of the Mouths . . . . . !"

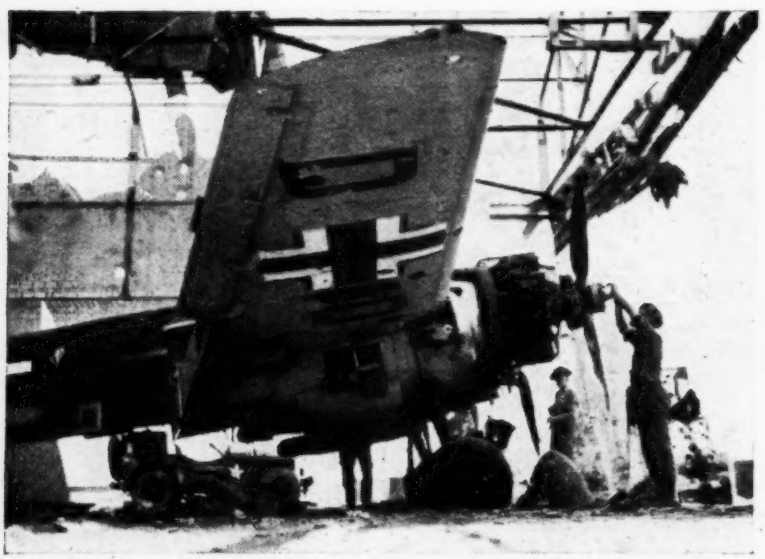
MRS. H. M. McNAB, President of McNab Incorporated, precision instrument manufacturers, Reuter reports, said last week that the remark of a four-year old boy led to the discovery of a new physics principle, the development of which might lead to the repelling of the German robot bombs.

She declined to elaborate on the device or on its principle, but said: "Scientists believe it is sound and a step in the directino of repelling the robot bombs and another weapon that may come from Germany."

Dominions Air Policy

MR. PETER FRASER, Prime Minister of New Zealand, said last week that New Zealand's post-war civil aviation outlook was appreciated in London and Washington.

It had been made clear, he said, that if the joint proposal of Australia and New Zealand for an international air



ALSO PILOTLESS! This Henschel Hs 129 fighter did not get away when the Canadians captured Carpiquet airfield near Caen; it was as pilotless as a doodle bug!

HERE AND THERE

service was not acceptable to the majority of nations concerned, then those Dominions wished for the most complete international control.

This control would cover routes and the reciprocity of landing rights and facilities, including refueling facilities at airports and mutual arrangements for the transport of passengers, mails and cargo.

New Zealand would favour the promotion of a British trans-Pacific air service, Empire owned and operated.

Aircraft Factory Chief Leaves

MR. BRIAN COLQUHOUN, Director General of Aircraft Production Factories of the Ministry of Works, resigns his post at the end of this month to go into private practice as a consulting engineer.

Mr. Colquhoun, who is 41, joined the Ministry of Aircraft Production in 1941. His job was to arrange for the building of aircraft factories to replace those which had been "blitzed," and his task is now completed.

He was chief engineer for the building of the Mersey Tunnel, and has been in charge of other important constructional work in Britain and abroad.

It is recorded that while at the M.A.P. he kept a pair of wooden scissors 3ft. long in the wall of his room inscribed "To be used for red tape only."

Lord Beaverbrook's Plan

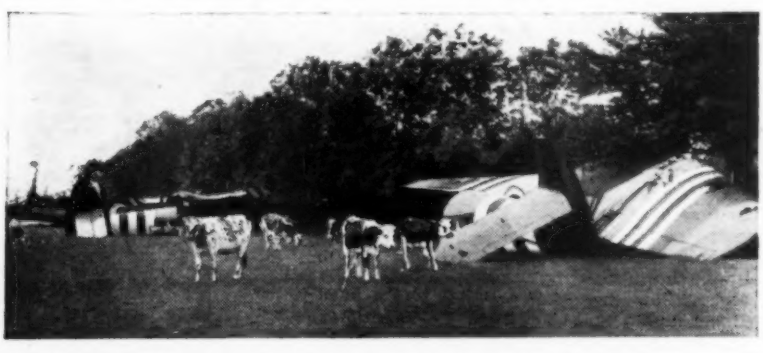
THE *American Aviation Daily* reports that it has received private advices from London indicating that "Lord Beaverbrook is laying plans for proposing that the British operate three airlines" after the war.

"These airlines," the newspaper says, "would be (1) A British world airways to operate on the major trade trunk routes of the world and engage in air commerce wherever concessions could be obtained. (2) An airline to serve the heavily travelled North Atlantic route and possibly major European centres; (3) An Empire link primarily for communications between Britain and her colonies and possessions, serving these areas under an arrangement which would permit exclusive British services.

"It is said that the British Overseas Airways Corporation might be the operator on the North Atlantic route as well as to certain other points," the newspaper said, and adds: "It is probable that Lord Beaverbrook has not perfected his plans to the point where a detailed announcement could be made."

PROTECTING THEIR EYES: A Taylorcraft Auster IV which spots for an R.A. battery in Normandy, being covered with camouflage netting in its blast pit.

"... and light but accurate *flak*."



EBB AND FLOW: As the tide of war recedes from the beachhead areas, normal life flows back again, as witness these cows grazing peacefully among Horsa gliders awaiting pick-up collection in a Normandy field.

"Journey Together"

THIS is the new title of the film dealing with Flying Training Command of the R.A.F. in which the famous star, Edward G. Robinson, plays the part of an American instructor. It was first announced under the title *Aircrew*.

The story deals with the adventures of David (Richard Attenborough) and John (Jack Watling) from when they join up until they ultimately go on "ops" as navigator and pilot respectively in the same Lancaster.

Nearly all the cast are R.A.F. personnel (David and John are actually A/C.2s), but all of them were actors in civilian life.

The film is being made by the R.A.F. Film Production Unit, and the chief idea is to show that the pilot of a bomber is no more important—and in certain circumstances may be less important—than any other member of the crew; in short, that it's team-work that counts all the time.

Look Out, Broadway!

THIS is the latest flying bomb story, in the *Stockholm Tidningen* which is unconfirmed from any other source.

The paper said: "Reports reaching us say that the Germans are concentrating in Western Jutland ten thousands of flying bombs of a new type. They are said to weigh 10 tons, to have a speed of about 750 miles an hour, can fly at 20,000ft., and are alleged to be capable of reaching New York. The explosive is said to be 30 times more powerful than the ordinary."

The newspaper assures its readers that this information is not just "clutched from the air" but admits that the details given of the range and explosive power of the bomb are "incredible," and does not believe that new flying bombs are capable of reaching New York.

D

Invasion Close-up

Air News from the Notebook of Our Correspondent with the Allied Expeditionary Air Forces

"BUT for us, there would not have been an invasion." These words greeted me when I visited a reconnaissance squadron and asked them to tell me something of their share of the invasion. In many ways their words seem true, because had we barged in on the Continent without a very complete picture of Hitler's defences, it is more than likely that we should have been thrown out again on our necks.

The wing I visited included a couple of squadrons which we first visited some thirty years ago and who since then have spent most of their time working with the Army. The time I spent with them coincided with the break-through at Caen, so it is easily understandable that they were reticent about the actual work in hand that day, and that they were very busy.

D-Day Duties

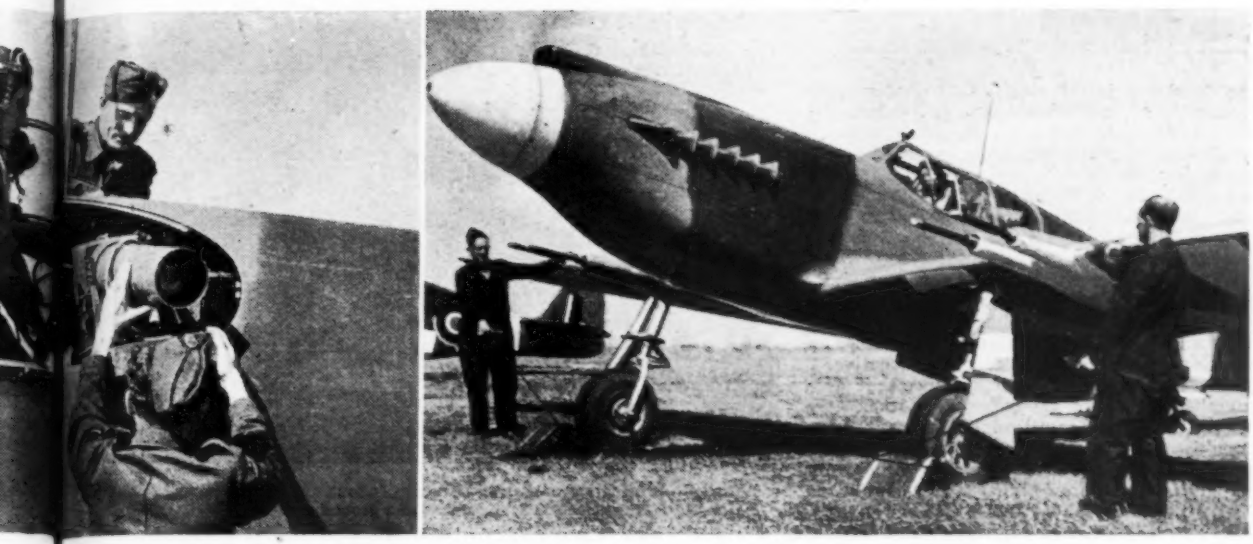
Normally their job consists of hunting in pairs—one looks after the other man's tail—while they make visual and photographic reconnaissances of pin-points given to them at their briefing. On D-day, however, they spotted for the guns because it was thought that their familiarity with the targets would be an advantage. This was undoubtedly so, but a return to their normal job was made as soon as possible afterwards. The biggest job they did for D-day was done weeks and months before June 6th. As a reconnaissance wing of the Second Tactical Air Force they had been engaged for a very long while on a D-day dossier which gave the staff planners photographic evidence of everything which was going on in enemy territory. Day in, day out, thousands of photographs were brought home showing the armour, transport and man-power of the German army in France. Others showed the coastal defences and radio installations in detail. How close do these pilots fly to get these pictures? I was shown one photograph which was taken so close and so low that a bullet fired from an upper window had penetrated the Mustang's wing through the upper surface. At the other end of the scale are the Spitfire XIs of the same wing which go out unarmed to photograph some pin-point line, or area, from 30,000ft.

The whole job is most exacting, and quite obviously, navigation and map-reading are of prime importance. There is no nice, roomy, chart table in a Mustang. The pilot must fly his machine mostly low down, navigate, map read, avoid *flak* and take his photographs at the same time. He must also bring all his training to bear on looking for things of military importance.

There is the story of the pilot who was briefed to photograph a bridge in occupied France. As usual he navigated the first part of the journey and then map-read his way to the final pin-point. There was, however, no bridge or any apparent sign of one at the indicated spot. So certain was he of his position that he photographed the spot in space, so to speak, and, sure enough, in the finished photograph the almost obliterated stumps of bridge piers could be faintly discerned right in the middle.

If needs be, the reconnaissance pilot must fight as well. The Mustang with four cannon is quite able to look after itself, but, generally speaking, its tail is protected by a companion whose sole job it is. Two Me 109s who tried to interfere with our photography were shot down by Mustangs last week.

(Centre). Back from the reconnaissance, the photographic staff remove the film container even before the pilot has time to dismount. (Right). Wet prints are rushed to the intelligence and liason officers who compare them with a large scale map and inspect them under a magnifying glass and a stereoscope. The pilot also lends a hand in the identification of ground objects.



(Left). The pilot is briefed by the Army-liaison and intelligence officers. (Centre). Watching the F24 camera, in its oblique mounting, being fitted behind his cockpit. (Right). After running up the Allison engine of his Mustang the pilot waves away the chocks and taxies out to the runway.

Flak, of course, is a nuisance because, as is to be expected, most of the objects worth photographing are equally worth defending. If a low-flying Mustang gets an unlucky hit he usually has sufficient forward speed to be able to pull up to about 1,500ft. and use his parachute. Should he be too low or too slow for that, the only chance left is a belly landing in the nearest decent field. Whoever thought of putting the camera in an oblique attitude behind the pilot's head certainly had a brain-wave. Sighted by bringing the object to be photographed in line with a mark on the trailing edge of the wing, there is no need for the pilot to fly straight and level and so invite trouble from *flak*. He can photograph a particularly "hot" spot from a reasonable distance or do an easy one in an almost vertical bank made low down over the target. This does not mean that the pilots are not prepared to go right in on the targets, however hotly they may be defended. If the need is there, the job will be done

The photographic and intelligence layout is of equal interest. The Strat. R (strategical reconnaissance) Spitfire XIs carry the F52 and F8 cameras. Both of these take the same size photograph—8½in. × 7in., but the F52 mounts a 36in. lens. The Tac. R (tactical reconnaissance) Mustangs IA and II carry an F24 or K24 camera, taking a square picture size 5in. × 5in. Both of these cameras are identical, the K only indicating that it is an American version built from designs supplied by Britain.

High Quality Results

Improvements in photographic emulsions, in lenses and in filters have all contributed a share in the high quality of the results now obtained. As it was put to me, "If a pilot can see it at all, he can photograph it." To one to whom air photography is no novelty; this is somewhat of a revelation. As a machine touches down and comes to rest a photographer is waiting to take the exposed film to

INVASION CLOSE-UP

be developed in the mobile field photographic section. As soon as the film is processed it was, until recently, the practice to run it while still wet over a viewing screen in order to give an urgent pre-view to army liaison officers in case there should be something which required the immediate attention of our guns or bombers. It is now found more satisfactory to run off quick prints and inspect these while still wet. These wet prints can be put under a magnifying glass or set up in a stereoscope in a manner which is impossible with continuous film. There is also the advantage of looking at a positive instead of a negative.

If a negative is of such importance that large numbers of copies are required, it then goes to the mechanical multi-printer (this apparatus was described in *Flight* in our issue of December 2nd, 1943) which can produce prints very rapidly. They are printed on a continuous band of photographic paper which, after exposure, passes over rollers into developer, fixing, and washing water. Finally the wet prints pass over a heated roller and emerge quite dry.

A cannon-armed reconnaissance Mustang about to receive a 40-hour inspection at the hands of a ground crew.

Intelligence and army liaison officers go over the photographs with a small tooth comb. To-day's photographs are compared with those of the same subject taken previously. Everything is checked to see what changes have occurred in the interval. Where two pictures have been taken with sufficient overlap (60 per cent. is usual) they can be put into a stereoscope and viewed in relief. This is one of the best methods of defeating camouflage, because an exaggerated relief can be obtained by the amount of separation between the two pictures at the time of taking. Long overlaps of roads, rivers or railways will show what quantity, and what sort of traffic is on them, and complete photographic cover of a battle area gives the ground forces a detailed and up-to-date map to go by. These big maps and overlaps are, of course, the work of Strat. R., or Photographic Reconnaissance units. Tac. R. deal almost entirely with the photographing of small pin-pointed subjects from a low height.

Living under field conditions, there is no luxury in the mess. Nevertheless, tea is just as acceptable.

Finally, there is that dream target that every pilot hopes to see while he is on patrol. That target which would justify every bomber and every gun being turned on immediately. I enquired about this and was informed that the pilot doesn't have to wait until he gets home before the "heat" is applied. Arrangements have been made.

THE BOMBS THAT STUCK

ON a Thunderbolt dive-bombing attack on rail lines in France, 2/Lt. Gordon T. Spinhirne, Winslow, Ill., released his two bombs, but the 500-pounder under his right wing did not drop, and he tried unsuccessfully to shake it loose.

Then another Thunderbolt pilot, 1/Lt. Robert E. O'Neill, of New Orleans, edged his left wing close under Spinhirne's right wing and dislodged the bomb, but it landed on his own left wing and started to roll inboard. O'Neill dropped his wing and the bomb halted, rolled slowly back, and fell clear.

OVER JUNGLE ON ONE ENGINE

A 700-MILE flight over Japanese-held territory on only one engine, with barely enough petrol to get them home, was the recent unenviable experience of the crew of an R.C.A.F. photo-reconnaissance Mosquito.

F/O. Jack Winship, of Winnipeg, and F/O. Peter Haines, R.A.F., of Leytonstone, were over Indo-China almost 800 miles from base when a leak developed in the cooling system. Winship dived to try to cool the overheated engine, but had lost only 3,000ft. when the whole system went u.s. and two petrol pumps went out of action. With speed down to 170 m.p.h. they flew more than four hours over dense jungle and almost all the time over Jap-held country. They were forced to jettison 100 gallons of precious fuel.

The two men said they were more worried about the petrol situation and the type of country they were over than about the possibility of meeting enemy fighters.

AUSTRALIAN-BUILT MOSQUITOES

FIRST deliveries of Australian-built Mosquito fighter-bombers have now been made to the R.A.A.F. in Australia.

In announcing this, the Australian Minister for Aircraft Production (Senator Cameron) said development of the Australian manufacture of the Mosquito had been proceeding for many months. They are being built by De Havilland Aircraft Pty., Ltd., Australian branch of the British company which developed the design that has proved so successful in all types of operational flights in Europe.

Factory executives told members of the British and Canadian Parliamentary delegation, who saw a Mosquito in its first public demonstration flight, that Australian woods were used to a great extent in its construction. The Australian Minister for Air (Mr. Drakeford) said the Mosquitoes could be used most advantageously in the Pacific area.

Engine Mountings

Some Main Features Encountered in the Design, and a Brief Survey of Some of the Types in Use Throughout the World on Military Aircraft

By MAURICE F. ALLWARD

MOUNTING the power unit has always been one of the major structural problems of the aircraft designer. Right from the beginning of the aircraft industry the design draughtsmen have done their best to harness the engine—which is by far the heaviest single item of the airframe—to the main structure with the lightest possible, yet adequately strong, structure—the engine mounting. To the layman a mounting without the engine may seem rather massive, but with the engine in position it appears alarmingly fragile. This is not surprising since the members from which the mounting is made are often as thin as a walking stick, and even to-day, when dealing with engines of 2,000 h.p. and more, are rarely thicker than a man's wrist.

It is evident from the general non-standardisation that the ideal mounting has yet to be found. A large number of different types of mountings are in use to-day, some of them being developed by a particular company, or country. There are three main reasons for the differences found: the engine itself, the type of structure to which it is attached, and the position of the engine in relation to that structure. Engines may be divided into classes when designing mountings:

A. Radial, e.g., Hercules, Wasp, and the BMW 801a.

B. In-line, e.g., Sabre, Allison, and the DB 601n.

At one time it seemed as if the radial engine was to be ousted, despite its easier maintenance, by the in-line engine with its lower drag and higher power, especially for fighter aircraft. This trend has been reversed, however, with the appearance of the Fw 190, the Thunderbolt, and the new Japanese Nakajima Navy S-01 fighter with its 1,050 h.p. Mitsubishi Kinsei radial engine and an estimated top speed of 387 m.p.h. Even to-day, while Great Britain has the 2,000 h.p. Napier Sabre in-line engine, America has no in-line engine approaching the Twin Wasp, or Germany one to compare with the 2,000 h.p. BMW 802 18-cylinder radial engine. One hears, too, about a new British radial "better than the Sabre," which the Germans have named as the Bristol Centaurus.

Stressing

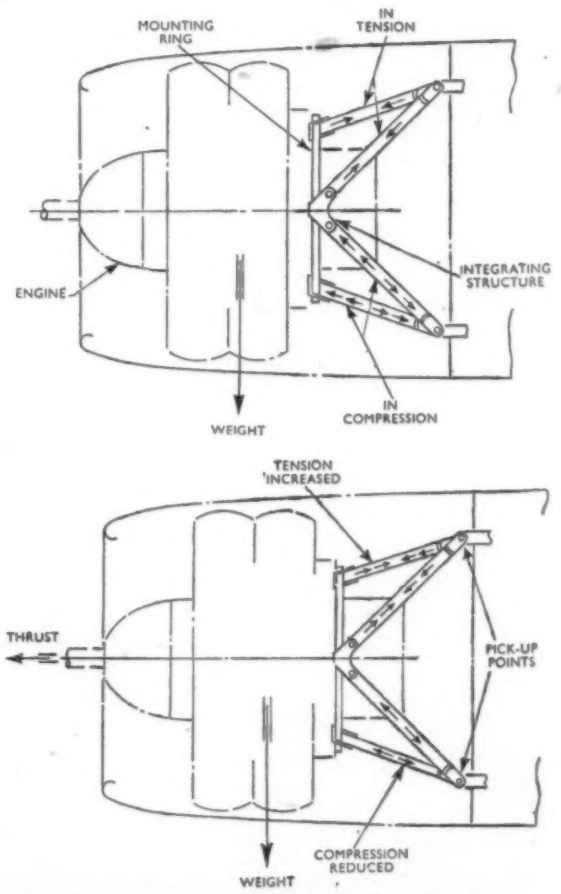
The greatest loads will be experienced when the aircraft is turning sharply in flight with engine on, and these may be divided into:

1. Loads due to gravity.
2. Airscrew thrust and torque.
3. Gyroscopic forces.

The latter is now only important when a large and heavy airscrew is used, but it attained considerable importance when rotary engines were much used. A different set of loads will be experienced when gliding and landing with the engine off, the weight of the engine itself exerting the principal load. A third set will be when the engine is run up on the ground and thus exerts maximum thrust and torque. The direction of the loading due to torque depends upon the sense in which the airscrew rotates. It is thus evident that the loads can be great in all directions.

The top members of a mounting will be in tension, while the lower ones will usually be in compression, due to the weight of the engine. In flight the thrust of the engine will increase the stress in the upper members and decrease that in the lower ones. Clever designs try to make the number of members in tension as great as possible, since relatively such members are much stronger than those under compression, there being no fear of failing by bending. In stressing, both welded and mechanically jointed mountings are regarded as being pin-jointed, and thus the centre lines of all members of each joint, if produced, have to meet at a single nodal point. If this assumption were not used, stressing such parts would be a great deal more difficult. In both methods of construction the factor of fixity may be increased comparatively easily, but only in a few special cases is this allowed for. In a mechanically jointed mounting, the bearing strength of bolts and plates at the joints is usually assumed to be only half of their normal strength.

When attached to the wings, the problem of stressing the mounting in particular, and the wing in general, becomes very involved and is more complicated than the stressing of the fuselage. The weight of the engine and its overhang puts down-loads on the front spar and up-loads on the rear spar. In flight this loading reduces the stress in the front spar and adds likewise to the air load on the rear spar. The thrust of the engine, the torque and gust conditions only complicate the matter. In fact, without detail stressing of the structure it is impossible to know what the total effect will be. In order to give the mounting the widest possible base, thus reducing the stress in the members, the



Stresses set up in a radial engine mounting. (Top) Engine "off" condition. (Bottom) With engine "on"

ENGINE MOUNTINGS

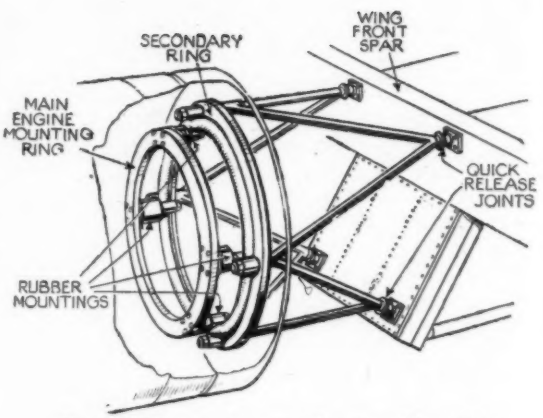
top horizontal members are bent up behind the engine and usually pick up on the top boom of the front spar. The lower members are carried below the spar to pick-up points which, as they are outside the wing contour, have to be faired-in. This is facilitated by the modern practice of attaching the undercarriage pivot bearings to these lower points and enables the designer to kill two birds with one stone. The problem of engine-mounting stressing is thus very complex and requires a great deal of mathematical and technical knowledge before it can be tackled successfully.

Radial Engine Mountings

Generally speaking, radial engines are attached to a vertical circular plate or mounting-ring, the ring being strutted back to the main structure. The type of strutting used depends chiefly upon the part of the airframe to which the engine is attached and the members available for attachment. Another aspect to be considered is the clearance needed for the rear or lower projections of the engine, and the accessibility required for such parts as superchargers, pumps and sparking plugs.

Although now chiefly used only in the lower-powered aircraft in service, a completely welded-up form of mounting gives a very stiff structure, suitable for taking the vibration of the engine. As the horse-power increases, vibrational troubles promise to give aircraft designers a headache at least equal to that caused by compressibility, and the design of anti-vibrational fixings and mountings will be a technique on its own. In a welded structure there are no bolts to wear or holes to get elongated and no bracing to become fatigued. (Fatigue is that phenomenon by which a structure becomes "tired" and fractures under a smaller oscillating load than would be required to break it if the load were applied steadily in the same direction). The more heavily-loaded members of a welded structure are sleeved at the ends for strength. It is important that such sleeves are chamfered, etc., to ensure that there is no localising of stresses, or a fracture is bound to result. The great disadvantage of a welded structure is the difficulty of quickly replacing a strut damaged by enemy action.

In view of the success enjoyed by forged in-line engine mountings on many different types of aircraft, it is strange that there are no forged mountings for radial



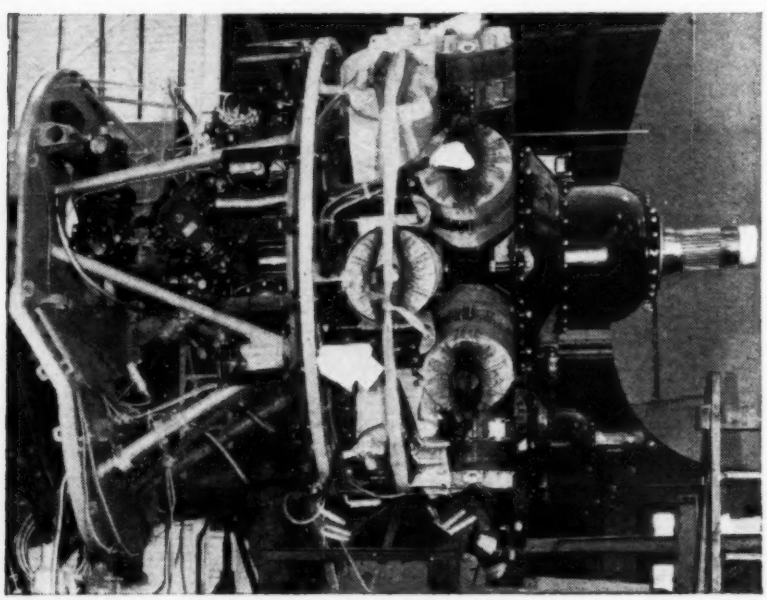
The BMW 802 engine mounting on a Do 217E2

engines. Suitably designed, they should weigh considerably less than those of tubular construction, be very strong, and suitable for rapid production. They would be exceptionally easy to assemble. According to an estimate, the weight of the complete mounting could be brought down to less than 100 lb. As the Germans seem to favour forged mountings, it will be interesting to see if they bring out a similar mounting for one of their radials.

Fw 190 A3 Mounting

The mountings on the Fw 190 A3 deserves special mention not only because of the unique purpose for which the mounting ring is used, but because it represents Germany's very latest in radial engine mountings. The hexagonal mounting ring, attached to the engine at 10 points, is hollow, being made from halves which are welded together, and is utilised as a reservoir for the hydraulic fluid needed for the operation of the airscrew. This is reminiscent of the Blohm und Voss BV 142, in which the tubular cranked spar of the main plane is used as a fuel tank. The ring is attached to the fuselage at five points: one at the bottom of the machine to the centre-line of the front spar; two and three pick up with eye-ends attached to the top boom of the front spar, very close to the wing attachment points; and four and five pick up with eye-ends on the front spar bulkhead. The fuselage pick-up points must have warranted a great deal of thought and careful design, for positioned where they are, they obviate any longerons and thus keep the fuselage very nearly a true monocoque. The integrating structure is of welded steel tubular construction. As in all German warplanes, the engine itself is carried by flexible rubber bushes, in order to reduce the vibration. Following modern practice, the installation is in the form of a "power egg" so that the engine together with accessories, mounting and cowling, can be removed from the fuselage as a complete unit. This power egg can be removed and replaced in just under four hours, which is very good indeed. For some minor maintenance work, however, the power egg has to be removed; on some installations this would be undertaken with the engine in position.

The weight of this mounting, including the cowling for the 1,700 h.p. BMW 801A engine (weight 2,059 lb.)



A SIMPLE MOUNTING: The Bristol Hercules in a Beaufighter.

is 250 lb., or 3 per cent. of the weight of the structure of the aircraft.

Do 217 e2

The mounting just described is very similar to those used on the Dornier DO 217 e2, except that on the latter the mounting is strutted back to the wing, instead of the fuselage. The weight is slightly greater than that used on the Fw, being 450 lb., but is only 1.4 per cent. of the weight of the structure. In this case the engines are the 2,000 h.p. BMW 802 18-cylinder engines weighing about 3,400 lb. each.

The Hercules Standardised Power Plant

It is probable that Bristols lead the world in the design of "power egg" units, and to-day the British aircraft industry is practically dependent upon Bristols and Rolls-Royce—by whom most of the other work has been done—for its supply of aircraft engines. A detailed account of the development of the Hercules appeared in *Flight* some time ago, and as the success of the Hercules Standardised Power Plant is in no small measure due to the simplicity of the mounting itself, here is a description of the latter.

The mounting ring consists of two mild-steel pressings welded together, with seven equally spaced holes bored to take the seven extended crankcase bolts by means of which the engine is secured to the mounting ring. Uniform spacing of the engine from the ring is obtained by the use of detachable distance pieces on the crankcase bolts.

On the after face of the mounting ring five supporting pieces are welded, through which pass the bolts securing the brackets for the engine-mounting tube structure. Each bracket is secured to the mounting ring by means of six $\frac{7}{8}$in. stainless steel bolts and nuts. The mounting-tubes are eight in number and are welded together to form a triangulated structure. Mounting-plates are welded in pairs at the ends of these tubes to provide four lugs, by which the power plant assembly is attached to the airframe. There are, therefore, only four pick-up points on the airframe for the whole engine mounting.

The fireproof bulkhead is a single sheet of stainless steel with four stiffeners disposed in the form of a square, which also provide rigid mountings for the engine control box, the gear box, and other heavy components. The bulkhead carries union connections for the various services, such as oil and fuel pipes, the airscrew pitch control and fire extinguisher, as well as electrical junction boxes, all situated in standardised positions.

Supports are also supplied for the nacelle cowling, etc., and for the Bristol controllable gills, which are driven by a small electric motor mounted on a pressed-steel bracket welded to the bulkhead.

The Bristol Hercules Standardised Power Plant is now being fitted to large numbers of Lancaster Mark IIs, and it is probably due in no small measure to the power and efficiency of these units that the Lancaster is credited with the lowest percentage loss of any four-engined bomber in the world.

Mitsubishi S-00

Authentic information of any sort on Japanese aircraft is scarce, and structural information especially so—they seem to be shrouded in the same veil of mystery that enfolds many types of Russian aircraft.

A few notes on the mounting of Japan's standard ship-board fighter—the Mitsubishi S-00, or the Zeke, as it is now known, may therefore be welcome. Of welded-steel construction, there is nothing outstanding in the design, and its whole appearance is in keeping with the rest of the machine and certainly helps the latter to have the remarkably low unloaded weight of only 3,775 lb. The engine attachments do not encircle the mounting ring, but only wrap partially around this tubular member. The anti-vibrational housings, of welded-steel plate form, are designed to prevent crushing of the rubber pads during the tightening of the mounting nuts. A total of 13 such housings is used. The attachment to the fuselage is unusual. It is fastened by tubular sockets which pick up with four threaded studs in stampings which, strange as it may seem, are riveted to the fuselage bulkhead. Thus to remove the mounting, four split-pinned nuts have to be undone. The engine itself is reasonably accessible, but one interesting point in the serviceability of the Zeke is that the engine, complete with mounting, must be removed before the oil tank can be inspected.

(*To be continued.*)

DIVERSION OF R.A.F. PERSONNEL TO OTHER SERVICES

THE Air Ministry has announced that His Majesty's Government have decided that a proportion of the young men who have been accepted for aircrew duties in the Royal Air Force and who are now awaiting entry to training will be made available to the Ministry of Labour and National Service for service in the Army or for other forms of national service in connection with the prosecution of the war.

The increasing superiority which the Royal Air Force and the Dominion and Allied Air Forces have achieved over the enemy in the air at a lower casualty rate than had been estimated has resulted in a balance of potential aircrews in excess of immediate needs, and the Air Council some months ago made certain reductions in the flying training organisation and reduced the intake of personnel for aircrew duties. The course of the war is now developing in a manner which demands that an increasing share of the best of the nation's man-power should be made available for the Army and, as operations develop on the Western Front, an ever-increasing burden will fall upon our military forces.

It is for these reasons, and particularly in order to reinforce the efforts which the Army are being called upon to make, that the Government have decided to divert to other duties a proportion of the aircrew recruits at present awaiting entry to full-time service.

To determine which airmen are to be retained for subsequent entry to flying training, the men concerned will be called up for examination and a personal interview by special boards. Each airman so recalled will be informed by the board before his departure or within the ensuing 14 days whether he has been selected for retention in the R.A.F. or will be diverted to another form of national service.

The Royal Air Force is most reluctant to lose the services of the airmen volunteers affected, many of whom will have had service in the A.T.C., but the highest strategical demands of the war must naturally transcend all other considerations, and it is in this spirit that these young men are being asked to accept this new situation.

In addition, a considerable number of airmen employed on ground duties are being transferred to the Army in the next few months, mainly from those who have recently been accepted for training. These airmen, who include personnel of the R.A.F. Regiment, will, subject to efficiency, receive pay not inferior to their R.A.F. rates of pay and good conduct badge pay until such time as they qualify for higher rates on promotion. Already many airmen have been transferred from the Royal Air Force for service in the Brigade of Guards and infantry of the line.

The planned expansion of the R.A.F. will proceed and personnel will continue to be accepted for aircrew although in small numbers and to a higher standard. Recruitment into the A.T.C. will also continue.

A COMBINED OPERATION

HOSPITAL Saturday Fund and the Air Training Corps (Battersea and Lambeth Squadrons) have joined forces, under the patronage of Lady Louis Mountbatten, in organising a concert in aid of their respective funds.

The concert will be held at the Coliseum, St. Martin's Lane, W.C.2, on Sunday next, July 30th, at 3 p.m., and amongst other first-rate artists Tommy Trinder, Arthur Askey, Harriet Cohen, Teddy Brown, and "Stinker" Murdoch will positively perform.

The joint "promoters" are working hard for a complete "sell out" for the concert, and can meet orders for tickets from 5s. to £5 5s., which can be obtained from Hospital Saturday Fund, 14-18, Holborn, E.C.1 (Cha. 6311), or the Secretary, 256 Squadron, A.T.C., 20, Holborn, E.C.1 (Hol. 1930).

In the event of cancellation of performance, all money received for tickets will be refunded.

In Topics of the Day "Indicator" Considers that Designers are

Asking Too Much of Adaptability

—in Pilots and Suggests a Peacetime Standardisation of View in Utility Aircraft with Realism in their Design and Development

IF the human being has no other remarkable qualities, he has two which, alone, would permit his continued survival in the strange, artificial, and sometimes ridiculous world which he has succeeded in making for himself and his fellow creatures. These are, first, the capacity for verbal or pictorial memory—so, consequently, of forethought based on previous experience (generally unpleasant)—and, second, the ability to accustom himself very quickly to odd conditions of life and to form habits of self-preserving action.

I will leave it to the philosophers to enlarge on the first and to explain, perhaps, that mankind's one and only superiority to the mastodon and the ant lies in this power of memorisation and consequent garnering of experience, so that he has become a very efficient reflex machine—much more so than his four-footed or finned automaton cousins. It would be amusing to write a few thousand words, with tongue in cheek, vigorously expounding some spur-of-the-moment theory which would prove us to be no better than mobile automatic telephone exchanges—but this is no place for such cynical meanderings.

Both qualities come very much to the fore during a war for survival and, in particular, during the training of pilots. We learn to live in dug-outs and to be no longer quite so naturally allergic to loud noises and bad smells in a restricted world; we learn, in a space not large enough to stand up or even to stretch one's legs, to handle mechanisms which require more concentration and co-ordination than that of a locomotive; and we learn to ignore the fact that within a few feet of our trembling little organisms there may be a heat engine developing as much power as that in the engine-room of a small steamship—and all to hoist one chap and a few small-calibre guns into the sky to do battle with his enemies.

As I've said before on this page, he can accustom himself to anything in the way of control layouts and flying characteristics, but, at least for the first few hours in a new and strange type, the pilot is inclined to be vaguely unhappy and uncomfortable. And not only when he progresses from comparatively simple types to those with a massive and lengthy control "drill." The fellow who has been on big aircraft for a few hundred hours is almost as uncomfortable when and if he returns to a fighter type as he was when he first started to take dual in a multi-engined contrivance.

Developing Second Nature

On "conversion" to the mightier weapon, he feels, for a few hours, that the thing is flying *him* and that he is merely the brains behind it all—and not very confident brains at that. He has a very great deal to look after, the controls feel heavy, and the layout in general seems to be unnatural. When the time comes to do the take-off or landing "drill" he suffers almost from a brain-storm. Yet, within a very few hours, the aircraft has become, once again, a mere extension of his own personality, with which he can do exactly as he wishes, without overmuch forethought or worry, running through his "drill" while chatting to the rear gunner on the inter-comm. and lowering his undercarriage or demanding checks from his flight-engineer while he is making a final turn in to land.

On his return to somewhat simpler types, his feelings, though different, are very little less unpleasant than they were during his first hour on a "heavy." He feels cramped; the almost entire lack of forward view when on the ground and while coming in to land worry him immensely; and, unless the aircraft is a very simple training or communications type, he is disturbed by the way in which all the various devices seem to be crowded in on him. He may even suffer a little from a mild form of claustrophobia as he closes the lid and settles down to the business of handling all this crowded gadgetry and of reading instruments which are just under his nose—or may even be partly out of sight unless he lowers or raises his seat.

Finally, he is conscious, too, of the critical "singleness" of the power which keeps him in the sky. When one of four fades out it is a small matter; when one of two fades out there is still lots of time for consideration; but when one of one splutters into silence there is no time at all, and the earth below seems to be a mass of tiny fields with brick walls, H.T. cables, houses, and all of what I've described before as the paraphernalia of urban existence.

Standardisation

In wartime very few pilots are lucky or unlucky enough to find it necessary to accustom themselves daily to different layouts, and those who need to have become so "accustomed to accustoming themselves" that it is of very little moment except when a completely new type is being explored. But in peace years these same pilots will not be in daily practice—unless, of course, they happen to be staying in the Service or flying professionally—and we might then at least make a real effort to introduce some sort of standardisation in the light and medium classes of aircraft. It is not so important that occasionally used items, such as undercarriage retraction controls and flap-levers, should be in the same relative positions, as that the major controls should be so, and that the view should be tolerably similar and cover the same range. There should be a standard and accepted length and position of control column, and a standard height of seat in relation to the base of the windscreen.

In black and white, these things do not sound very important, and the business of setting any sort of standard would appear, on the face of it, to be almost impossible, but I know that the pupil pilot's greatest difficulties in mastering a new type are concerned with these very minor points rather, for instance, than with any slight variations in ground and approach angles or characteristics. And after this war, those who are not flying professionally will be almost back to the position of pupils, and should be given the best possible chance to see where they are going and on what they are landing.

Forward view is, too, going to be of immense importance if and when touring aircraft come into their own again and are used in any quantity. The owner or hirer, in a crowded sky, is certainly not going to tolerate the sort of obstructions with which he happily put up once upon a time, or the sort of view which one gets even out of a modern single-seater fighter, and after a few dozen unnecessary collisions the underwriters will probably insist on both improvement and standardisation. The latter is almost more important than the view itself; the relative variations in view between one aircraft and another cause most of the danger in casual flying around an airfield, because the pilots may accidentally close in on their different blind spots.

Not that I look on the collision danger as likely to be very great for many years to come, and even in the comparatively crowded skies of to-day near-misses or phenomenal avoidances rarely occur except in the sort of weather conditions which force all the aircraft to fly locally between certain limited height layers. Under a low cloud-ceiling one meets more aircraft per cubic mile than at any

ASKING TOO MUCH OF ADAPTABILITY

other time, yet there are probably fewer aircraft actually in the sky.

Incidentally, let us, when peace *does* come, try to be thoroughly realistic about private and commercial flying, striking a correct balance between ludicrous optimism, which will cost the more credulous investors a great deal and may put back the clock for many years, and undue pessimism which will discourage people to the same effect. A great deal, of course, depends on the degree of prosperity which we can expect and on such little matters as the cost of aviation fuel, but the prospects are there in fair if not fabulous degree.

Whatever the developments in design, the light aircraft will never oust the car, but will be supplementary to it, and the transport aircraft will be supplementary to the steamship or train, yet few who can afford not to do so will continue to use surface transport for direct long-distance journeys. Even on the comparatively clear roads of wartime, motoring, treated as a mere means of getting somewhere rather than as a pastime, can be a tedious business involving one in constant attention and labour. Given reasonable weather (and there's the catch!) flying between A and B is a restful and easy business by comparison. But it is not particularly exciting; one cannot carry the same amount of luggage or number of friends in anything but a millionaire's private transport needing a real airfield at each end; and one just cannot say that one will leave at such a time or arrive at such a time. In fact, private aircraft, whether hired or owned, may make us less clock-conscious and give us a more celestial outlook. This will undoubtedly do our nervous systems a power of good—though the commercial traveller with a bicycle will, when the weather is bad, do better business than the traveller of an advanced sort of firm owning a few light aircraft. Good luck to him; what is a bit of business one way or the other, anyway?

As for the people, and there are many of them, who so easily visualise helicopters landing in their back gardens—they've got a long and painful think in front of them. In its present stage of development the helicopter is a most expensive beast, both to manufacture and to maintain, and the tuition time required for its mastery, even by an already competent pilot of conventional aircraft, is, I believe, in the region of twenty-five hours for any degree of tennis-court precision.

INDICATOR.

Technical Education

Aim, Scope and Organisation of D.H. School

THE problem of providing a flow of new blood in the arteries of the aircraft industry is one that is not very easy of solution. That there will always be a reservoir of eager youth on which to draw cannot be doubted, but to ensure the continued "healthiness" and pride of place our aircraft industry now possesses, something more is needed. Aviation, in common with other industries of our modern world, tends, as time goes on, to become ever more sub-divided into specialist fields, and it is no exaggeration to say that the men engaged in aviation during the next three decades will require an increasingly specialised training for the jobs they are to do—this training to be superimposed upon a basic "over-all" background training in order that each man shall have a sound knowledge of the limitations, scope and requirements of the other man's work, together with an accurate appreciation of the whole aviation picture.

The De Havilland Aircraft Company realised this precept as early as 1928, and their Aeronautical Technical School was inaugurated in that year to fulfil in some measure the requirements recognised. As a complementary method of training to be carried out on different lines, the company also developed a system of apprenticeship, which has since become merged into the organisation of the school, and evolved scholarships to open the way to the full course in aeronautical engineering.

In May, 1943, an education board comprised of senior officials from the various groups of the firm's enterprises was formed under the chairmanship of the managing director, Mr. F. T. Hearle. The purpose of the board is to consider the future needs of technical education within the companies, and to direct and develop the policy of the D.H. technical school in accordance with its findings. It is felt by the board that industrial concerns must have, and put into practice, clear ideas of the training necessary for the youth they are engaging, and, in addition, they must have plans for making such training available in conjunction with local authorities.

Board's Work

Over a year has been spent by the education board in investigating the probable needs of the future, and also in comparing their own training system with the systems employed by several other first-class engineering concerns. The board has also devoted a great deal of time to exploring county educational facilities and plans, and to examining costs and statistics.

The result of these investigations is the development of channels of opportunity for training, open to young people who enter the aircraft, engine or airscrew divisions of the De Havilland company in Great Britain; or are seconded for training from the firm's associated companies in the Dominions. These training opportunities are set out in graphic form on two charts—which space forbids our reproducing—one applying to the aircraft division, and the other to the engine and airscrew division; but it is stated that the lay-out shown is not final as alteration may become necessary when the Government's new educational legislation starts taking effect. In the meantime, the charts illustrate a system approximating closely to the well-tried De Havilland system at present operating.

Youngsters entering the company can be divided into three grades: (1) the trade apprentice, entering at about 15½ to 16½ years of age for a 4½ to 5 years' indenture; (2) the engineering apprentice, entering at about 17 years of age for approximately five years' training; (3) the engineering student, coming in smaller numbers into the industry from the Universities at roughly 21 years of age in order to obtain practical training.

Theory and Practice

The system provides that both trade and engineering apprentices spend their first year in the school workshops and the remaining years in the factory workshops. Theoretical courses are compulsory for trade apprentices for the first two or three years, and optional thereafter; but for engineering apprentices they are rather more comprehensive and are compulsory throughout, with specialisation during the last two years.

The subjects covered are, broadly, mathematics, mechanics, drawing and design, aircraft materials, structures, stressing, aerodynamics, jig and tool design, metallurgy, hydraulics, ground engineering subjects, and commercial practice. The younger trade apprentices take general subjects, including English, literature, industrial history, commercial geography, etc. More attention, however, is to be devoted to Empire history and policy, citizenship, current ideas and ideals, and to De Havilland history and aims.

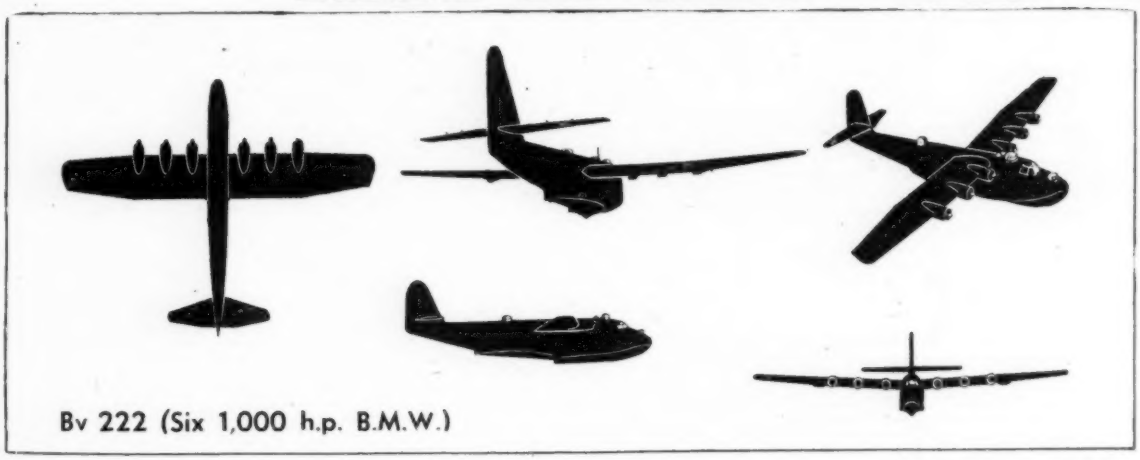
Intake and the selection of trainees is controlled by selection panels drawn from the school staff and the company's executives. It is strongly felt—and very sensibly—that every juvenile entering the organisation, whether apprenticed or not, should come under the watchful eye of the educational staff, and should have the opportunities fully explained; moreover, the old practice of haphazardly "picking up" a trade should be eliminated altogether.

Under this progressive and excellent system of educating its employees, the De Havilland company have opened the gateway of very real opportunity for the ordinary lad from an elementary school to enter the firm and, by help from the firm itself and with his own ability and merit, eventually to hold the highest executive post.

The scheme described will, undoubtedly, prove the unqualified success that the famous technical school has done, and by initiating so excellent a system, the company has probably set the standard by which other organisations will be judged.

Studies in Recognition

Aircraft in Fli

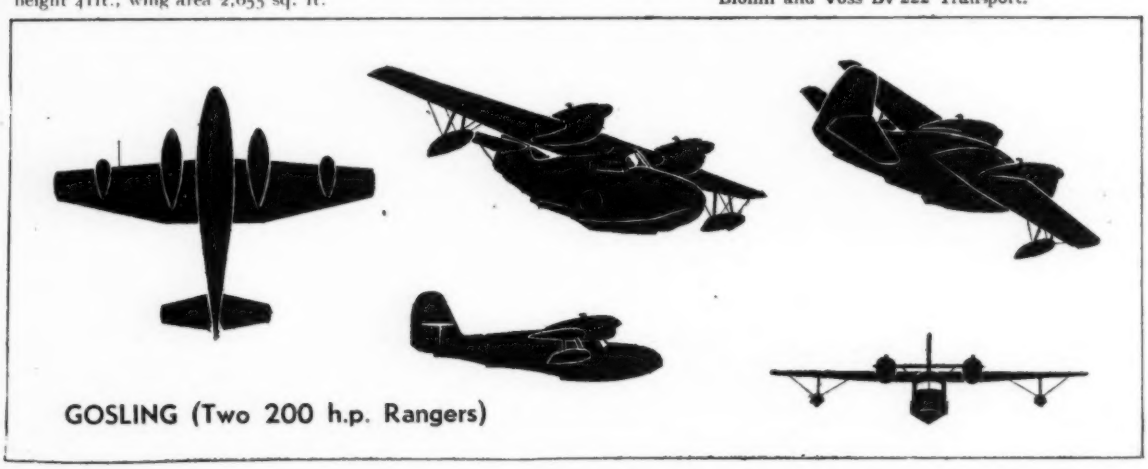


Bv 222 (Six 1,000 h.p. B.M.W.)

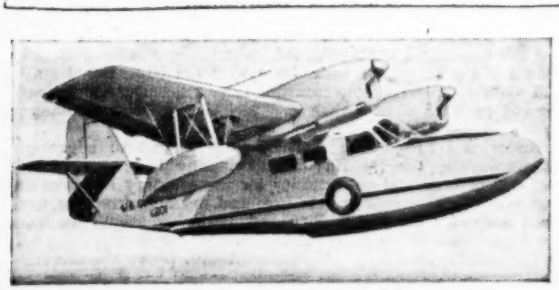
DEUTSCHE LUFTHANSA intended, before the war, to run a transatlantic service with Blohm and Voss Bv 222 six-engined flying boats about to go into production, the idea being really spacious accommodation. With the coming of war, however, the design details were at once modified to convert them into military transports. A limited number have been employed and several were shot down into the Mediterranean when trying to reinforce Rommel in Tunisia. Powered by six 1,000 h.p. B.M.W. radials, the top speed is 175 m.p.h.

The cantilever high wing carries the six engines in the wide rectangular centre-section, the comparatively short outer panels tapering slightly to square raked tips. Tailplane has back-swept leading edge and small square tips; tall fin and rudder; deep long fuselage. Dimensions: Span 150ft., length 112ft., height 41ft., wing area 2,655 sq. ft.

Blohm and Voss Bv 222 Transport.



GOSLING (Two 200 h.p. Rangers)

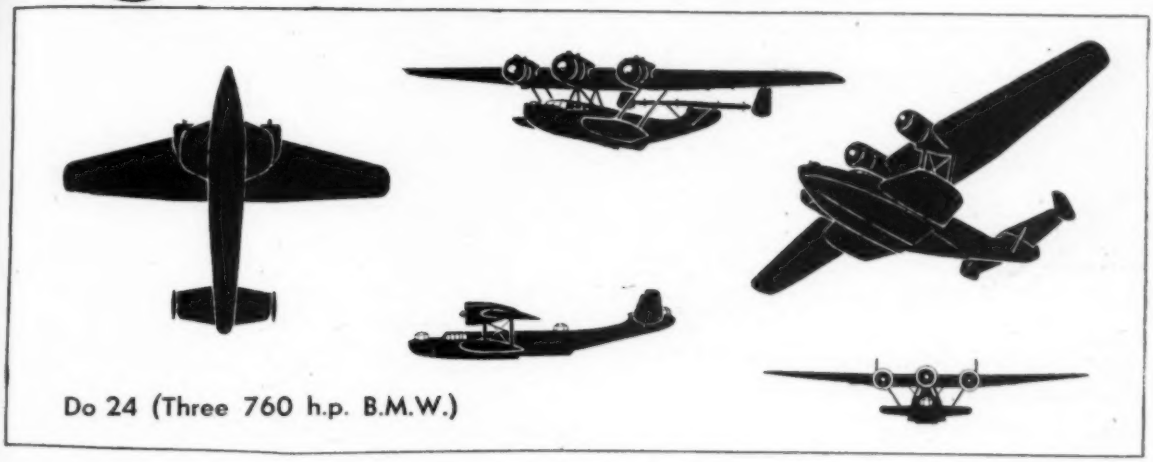


Grumman Gosling (J4F-1) General Utility.

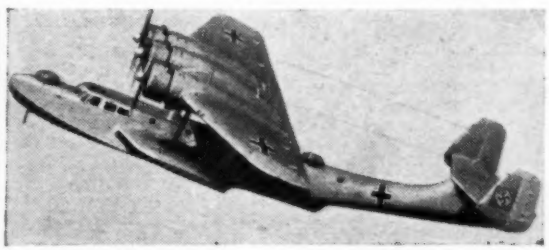
MILITARY version of the Grumman G-44 "Widgeon" light commercial amphibian, the Gosling, a few of which have been acquired by the R.A.F., is known in the U.S. Navy and Coast Guard Service as the J4F-1. It is virtually a smaller edition of the more widely used Grumman Goose, and was originally meant for air-taxi work and to appeal to the wealthier type of private owner. Two 200 h.p. Ranger engines give the Gosling a top speed of about 170 m.p.h.

The cantilever high wing tapers on the trailing edge outboard of the nacelles to square tips, but the wide-span strut-braced tailplane has symmetrical taper to square tips and is mounted upon the large angular fin. The slab-sided hull is roomy, and takes four or five occupants, the two front seats being well ahead of the leading edge. Fixed wire-braced wing-floats are fitted. Dimensions: Span 40ft., length 31ft., height 9ft., wing area 245 sq. ft.

Flying Attitudes



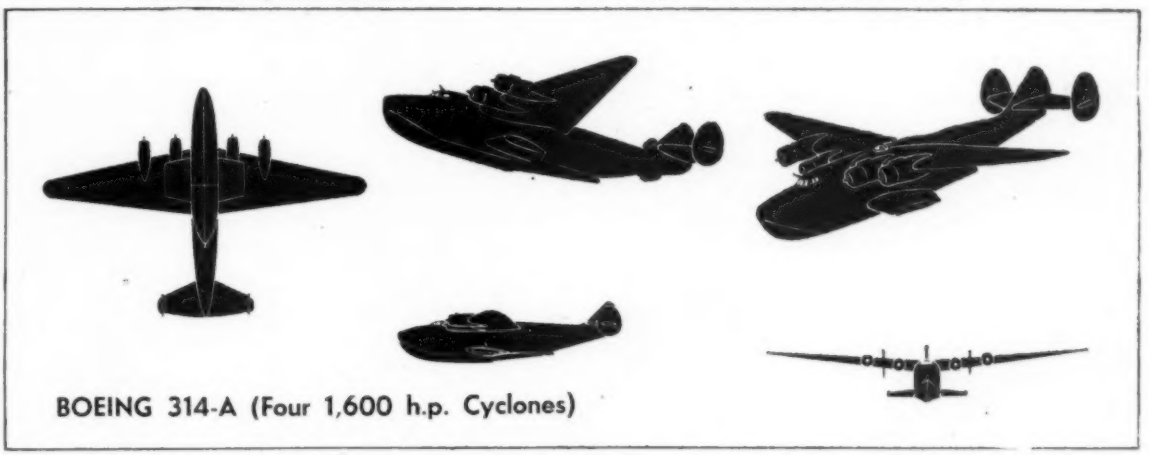
Do 24 (Three 760 h.p. B.M.W.)



Dornier Do 24 Reconnaissance

ONE of the most useful flying boats possessed by Germany, the Dornier Do 24, has been widely used for reconnaissance in the Baltic and North Sea. It is distinguished by its three 760 h.p. B.M.W. radial engines mounted on the flat centre-section of its parasol high wing, the centre unit being slightly higher than the two outboard engines. Top speed is 195 m.p.h.

The parasol wing is supported at centre on inverted V-struts and is braced from beneath the outer pair of nacelles to the fairly large sponsons ("stummeln") or sea-wings. The leading edge is sharply backswept outboard of the engines, but the trailing edge is almost straight and the tips blunt; a low aspect-ratio tailplane on the raised stern of the hull carries twin end-plate fins and rudders tapering towards the apecies. The hull is long and slim. Dimensions: Span 88ft. 7in., length 72ft. 2in., height 17ft. 10in., wing area 1,162 sq. ft.



BOEING 314-A (Four 1,600 h.p. Cyclones)

POWERED by four 1,600 h.p. 14-cylinder Wright double-row Cyclones, the Boeing 314-A "Clipper" has a top speed of 210 m.p.h. Three of them were acquired by B.O.A.C. and named *Bristol, Berwick* and *Bangor,* and have been giving invaluable wartime service. In peacetime trim, the Clipper type carries 68 day passengers or 36 sleepers, while mail and cargo holds have a capacity of some five tons.

Chief recognition features are its triple tail, tapered cantilever high wings with more dihedral angle (from roots) than is usual, and sponsons, or sea-wings, that taper in plan and thickness. The low aspect-ratio tailplane has a backswept leading edge and round tips threading the egg-shaped twin fins and rudders, and is mounted at the base of the central fixed fin. The deep slab-sided hull is rounded on top. Dimensions: Span 152ft., length 106ft., height 20ft. 4in., wing area 2,940 sq. ft.

Boeing 314-A "Clipper" Transatlantic.

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Luftwaffe Loss

LT. EUGEN ZWEIGERT, holder of the Knight's Insignia to the Iron Cross, and one of *Luftwaffe's* aces, credited with 69 shot down Allied aircraft, has been killed on the western front.

From Budapest

THE Hungarian Government has appointed a special commissioner for the aircraft industry, whose duties are to supervise and facilitate the supply of man-power, transport and raw materials for the aircraft industry.

Aircraft Shortage

REPORTS from Trondelag confirm Norwegian observations from other parts of the country that the *Luftwaffe* has at present very few aircraft at its disposal in Norway.

Vernes airfield on Trondheimsfjord has only 25 aircraft stationed there. Lade airfield, near Trondheim, has only 10 bombers, and no more than six seaplanes are stationed at Ilsvika, and about 12 at the Hommelvika base.

According to reliable reports, about one month ago 30 modern bombers arrived at the Lade airfield, but were sent away after one week's stay.

Luftwaffe Relies on Veterans

DESCRIBING the air battles in the invasion area, a German commentator says that "the success of the German fighter is largely due to the fact that the *Luftwaffe* have fast, manœuvrable and technically highly developed aircraft at their disposal, *at least equal to the undoubtedly efficient U.S. and British fighters.*

"We are offsetting any numerical superiority of the enemy," the commentator adds, "by the employment of highly trained and veteran flying personnel. . . . Names like Priller, Buchlingen, Wurmheller, Lang, Weissenburger—all fighter pilots with more than 100 (*sic!*) aircraft shot down to their credit, in some cases all of them British and U.S. aircraft, bear out the fact that personality holds its own against numbers."

Jap Science

THE mobilisation of scientific workers is announced from Japan.

Announcing the new order, the Japanese News Agency said that it takes immediate effect and is designed to bolster the production of aircraft.

In view of the heavy losses in aircraft inflicted on them by the Allies, this is understandable.

In Retrospect

"HE who has conquered everything from the East Prussian border up to 10 kilometres from Leningrad ought to be able to march these 10 km. from outside Leningrad to the city itself."

"Nobody will be able to free this city and she will fall into our hands."—(*From the Fuehrer's speech on the putch anniversary, November 8th, 1941, at the Beer Hall, Munich.*)

WHERE IS THE *LUFTWAFFE?* A small piece of it is shown here on an airfield in the Kandalakscea area of Northern Finland.

Admission

"GERMAN quarters do not conceal the fact that the tremendous Allied air strength is detrimental to the supplying of the German troops and causes the advancing divisions countless difficulties," says a provincial paper in Holland.

The air superiority of the attackers, the article explains, has meant that only absolute necessities are transported by day. "The German airfields also have to suffer because they are harassed by intensive and concentrated attacks."

Weather Service

A FRENCH State Meteorological Service will now take the place of the local networks operated by the Departmental Meteorological Commissions. In addition to this unification of net services, the Vichy Government has decided to set up a Centre for Higher Studies of Atmospheric Mechanics and Physics.

Escape to Freedom

A 20-YEARS-OLD Danish aircraft mechanic who had never himself flown stole an old German Heinkel from the Kastrup airfield, managed to take off with some difficulty, and set course across the Sound. The Germans discovered the theft, fired at him, but missed.

Over the Helsingborg area he was fired on by the Swedish A.A., and as he could not signal his intention to land, the aircraft was hit and crashed from about 80ft. But the young Dane is hale and sound and has reached his objective.

Fokker

FROM neutral sources it is reported that the Germans are using operationally the Fokker G.1 twin-engined fighter, a pre-war creation of the famous Dutch aircraft builders.

The original G.1 was designed either for mixed construction or with all-metal wings. The two-seater carried an extensive armament consisting of two automatic cannons of 23 mm. and two Madsen machine guns of 7.9 mm. operated by the pilot, and a rear 7.9 gun in a rotatable turret for the observer.

The prototype was designed to be powered with two Hispano Suiza 80-02 engines of 750 h.p. maximum power output.

Allied Airmen Aided

MANY enemy airmen have succeeded in escaping and have returned to Britain and Russia owing to the population's carelessness, complains the *Berliner Lokal Anzeiger.* "Unharmed airmen's uniforms are easily changed into mufti by tearing off badges and then the men resemble workers, particularly mechanics at work. They have plenty of funds to buy tickets and whatever they need for travelling."

After admonishing people to exercise more vigilance on suspicious characters on railway stations, etc., the article then reveals that conscripted workers from enemy countries readily assist escaping airmen by giving them clothes and food and even their own identity cards.

Aircraft Suspension Systems

Notes on Articulated and Telescoping-tube Types : A New Compensating Bearing for Correcting "Binding" in Cantilever Oleo Legs

By F. E. BURGER

A BALANCE must be established in the mind of the user between the various merits and demerits of the two most popular types of undercarriage at present in general use: levered and cantilever suspension. Exponents of one type sometimes tend to overlook certain features of that type at the expense of the other.

It should be remembered that the primary function of an undercarriage is to absorb energy due to the vertical component of the aircraft's landing speed, the forward component being taken care of by the braking system on the wheels. If this fundamental condition is accepted, it immediately becomes apparent that in a perfect system a simple sliding-tube arrangement or cantilever type of undercarriage is all that is necessary to fulfil the requirements. As has been pointed out in a recent article on this subject, the principal demerit of the simple type of undercarriage leg has been one major imperfection, namely, that under the influence of drag loads caused by rough airfields and severe braking, the sliding member develops a pronounced tendency to bind in its bearings and thus resists closure under vertical loads.

IN our issue of March 30th, 1944, we published an article on levered suspension, by Mr. R. H. Bound, in which he argued the merits of that type of aircraft leg. The author of the present article is assistant chief engineer to Sir George Godfrey and Partners, Ltd. He puts the case for the simple telescopic cantilever leg and describes a new bearing which it is claimed, will cure the "sticking" trouble likely to be encountered when a plain bearing is used.

It is evident that the swing-over to the levered suspension leg has been entirely due to the badly conditioned airfield surfaces normally met with in this country, aggravated to a smaller degree by the increased braking forces now demanded. This is borne out by the remarkable absence of articulated undercarriages in America, where runways have almost entirely superseded the grass airfield.

As previously mentioned, a cause contributory to "sticking" of the sliding member in its bearings is the braking force applied at the point of tyre contact which provides a load normal to the sliding member, thereby producing bending deflections.

Levered Suspension

In a recent article in *Flight* the author featured as a merit of levered suspension the ability of the swinging arm to rotate under the influence of braking forces which tend further to close the shock absorber element and thereby dissipate in that element a proportion of the drag load. This, however, is somewhat of a delusion, since the implication is that under application of the brakes and subsequent closure of the shock absorber, the ground reaction at the tyre is reduced as the natural effect of the fact that the shock absorber's closure allows the mass of the aircraft to be lowered.

This reduction of the vertical reaction will allow the tyre to skid unless the brakes are released at the exact moment, and will cause the aircraft to "hop" along the ground, resulting in an increased landing run and a materially decreased tyre life. A close parallel is that of a car whose brakes are so mal-adjusted that the rear wheels provide most of the retarding force at the instant of brake application. Any observant motorist will have seen the "dotted line" form that many skid-marks take on our roads—this is caused initially by a reduction in load at a critical moment, and thereafter by a periodic load variation on the wheels.

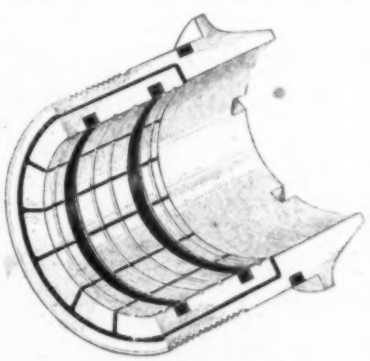
The obvious solution to this effect is to rake the lever forward instead of trailing it behind, so that any application of the brakes will increase the ground reaction by opening the shock absorber unit and raising the aircraft. This arrangement immediately throws away the main advantage claimed for levered suspension, namely, its resilient properties under drag loads.

Another advantage claimed for levered suspension is that, since the shock absorber unit is of the order of one-quarter of the length of a telescopic-leg unit, the machining problems associated with precision bores are thereby considerably reduced. This is a sound point where highly polished internal bores are utilised, but fails to hold good in oleo units whose design does not call for such highly finished internal surfaces. Shock absorbers of the latter kind have highly finished and polished shafts as opposed to bores, and it is universally admitted that these present very little difficulty indeed, whatever lengths are involved.

Relative Weights

A further point worthy of the aircraft designer's consideration concerns the relative weights of the two systems. Analysis shows that whereas on light aircraft there is very little to choose between one system and another (although the articulated unit always involves the use of a multiplicity of parts), the weight disadvantage of the articulated method as compared with the cantilevered method becomes very pronounced over the range of medium to large aircraft.

As a result of this discussion, which should preferably be read as a supplement to other articles on the same subject, it becomes evident that the trend of undercarriage design is likely to lean towards the reinstatement of a simple kind of sliding-tube cantilevered undercarriage in the very near future, as this country and the Continent adopt the American methods of airport construction, especially if the disadvantage of binding of the sliding member under braking loads can be successfully eliminated. This tendency has really been the fly in the ointment of telescoping-tube undercarriages in the past, but methods now being devised promise to effect a cure. One solution to this problem is shown in the accompanying illustrations.



Jaru Compensating Bearing

It will be appreciated that the sliding member of an undercarriage is carried in bearings placed apart in a supporting cylinder, and that this sliding tube must be, in order to reduce weight to the minimum, of a very thin wall-section in relation to its diameter. When the wheel is heavily braked, or meets a bump during taxying, the sliding member is subjected to bending loads which cause deflections in

AIRCRAFT SUSPENSION SYSTEMS

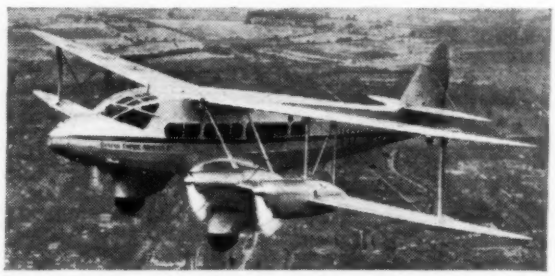
the length, and ovalling in the cross-section of the tube. It will further be realised that these deflections are most serious at the lower bearing of the undercarriage, where the bending moments are at their highest value. The bearing illustrated is composed of a bronze liner split radially into a number of segments, each segment being bonded to the other and to an outer shell with a plastic medium. A little thought will show that these segments, being elastically suspended around the sliding member, will, by virtue of the degrees of freedom established, compensate for deformities such as have been outlined above and permit the telescoping undercarriage to compete on equal terms with its young brother, the levered undercarriage. A further advantage of such a compensating device is that the sealing glands used at the base of the shock absorber will also "follow" the deformed contour of the sliding tube and thus eliminate the leakage of fluid and air at this critical point.

QANTAS QUALITY

THE original de Havilland D.H.86 aircraft VH-USC *Canberra*, one of the six supplied to Qantas Empire Airways in 1934, has now flown 1,500,000 miles.

Capt. Lester J. Brain, chief test pilot of Qantas, flew this craft out from Croydon to Brisbane in August, 1934. From December that year it did four years' regular service on the 4,361-mile Brisbane-Singapore section of the England-Australia mail, and when Short Empire flying boats took over the route, VH-USC was sold to McRobertson Miller Aviation until requisitioned by the Royal Australian Air Force at the beginning of the war as a flying classroom for navigators. Subsequently, Qantas got the aircraft back again for war transport duties, including aerial supply dropping in New Guinea and service in the Mount Hagen evacuation and in the Buna campaign.

Now *Canberra* is flying the Qantas inland route once again. At May 31st, 1944, its log showed 11,664 hours, which at a speed averaging 125.9 m.p.h., accounts for 1,468,533 miles.



The D.H.86 *Canberra*

IN NORTHERN WATERS

(Top) A Corsair, hit by flak, is brought in by its wounded pilot at 11 p.m. in the Arctic sunshine. (Right) H.M. escort carriers *Emperor* and *Striker*, with their attendant destroyer, roll in a heavy swell. (Bottom) Vought Corsairs and Fairey Barracudas on the flying deck of one of the carriers.

British carrier-borne aircraft discovered an enemy convoy of two 6,000-ton merchantmen and one 3,000-ton supply ship, escorted by four flak ships, north-east of Stadlandet, off the Norwegian coast. Both merchantmen were hit, the stern was blown off the supply ship and all four flak ships were silenced and left burning. The Admiralty communiqué citing the action declared that the convoy was virtually annihilated.

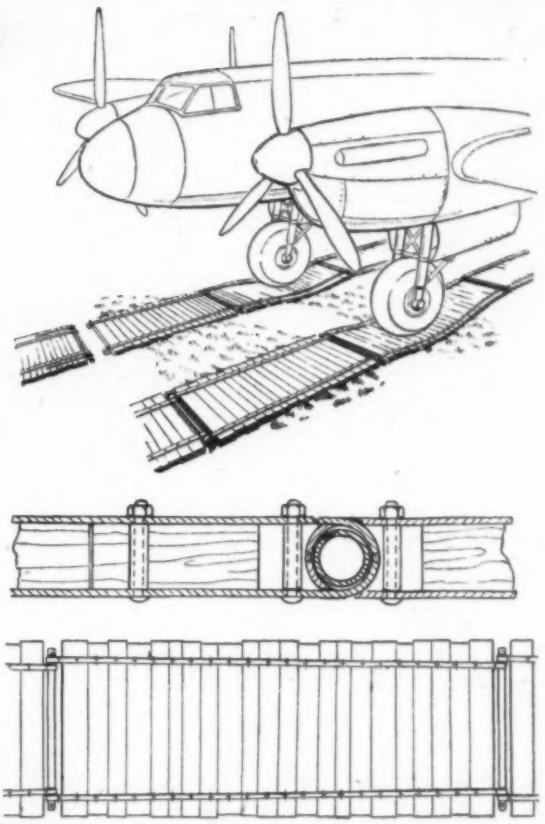
Airfield Roads and Runways

Somerfeld Flexboards and Track Used for Surfacing Temporary Airfields

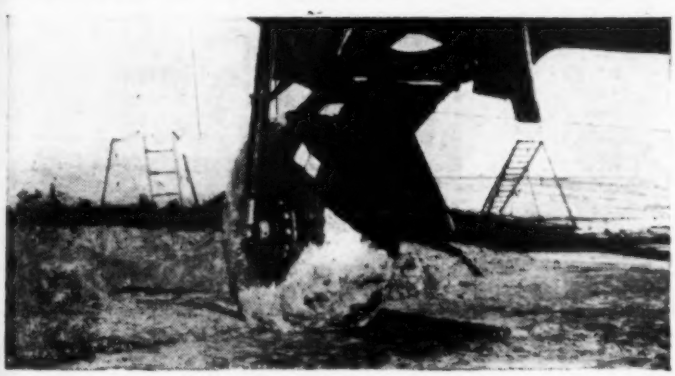
THE construction of surfaces capable of supporting, as both live and dead weights, aircraft ranging in size from Spitfires and Mustangs to Lancasters and Fortresses is not, at the best of times, anything less than a considerable engineering job; in times such as these, with the necessity of establishing forward airfields on ground literally just vacated by the enemy, the problem becomes an acute one of man-power, equipment, shipping space and time required. Were there no alternative to the concrete or bituminous composition runways and standings which are a feature of our "permanent" airfields, the outlook would indeed be a sorry one; but due to the efforts of an inventor and the results of his labours just before the outbreak of war, the problem of providing runways, taxi-strips, standings and aprons for our advanced airfields, even on semi-marsh or waterlogged ground, has been solved.

The basis of this surfacing, the Somerfeld Track, is a membrane of wire netting stiffened laterally by steel rods at 9in. centres to provide exceptional load-carrying capacity, whilst at the same time retaining longitudinal flexibility, so permitting the material to be rolled up. On occasion, for example on swampy ground, an additional layer of coir or coconut matting is employed to supplement the wire netting.

The lateral stiffening rods have a loop on each end through which the selvedge of the wire netting is stretched, the loops being subsequently closed and welded. Any desired number of widths of the track can be unrolled side-by-side and linked by threading flat steel bars through the loops—the whole of the width is then strained, usually by bulldozer or tractor, in order to obtain a "tennis-racquet" tautness.



The construction of Somerfeld Flexboarding and its employment as a temporary road over bad ground.



A length of Somerfeld Flexboard used to "de-bog" a Stirling.

Speedy Laying

Lengths of track are anchored by means of pickets made of angle-iron with a flat cap or head. Pickets are driven on the outside edges only, which maintains the "taut-mat" effect in addition to keeping the track secured.

The first Somerfeld Track runway was laid on a fighter station early in 1941 and is still perfectly efficient. By early 1942, special units of the R.A.F. had the job so "buttoned up" that a complete track runway, 1,000 yd. long by 52 yd. wide, was laid in 11¾ hours. In a broadcast recently a B.B.C. correspondent said "there is one landing strip which I remember in particular near the Volturno River in Italy. I thought it was a hopeless proposition at first, because it seemed to be a swamp. But, after the place had been swept for mines, up came a power-driven trencher which quickly cut trenches across the ground so that proper drainage could be laid in. Then came the excavators and bulldozers to level out the

AIRFIELD ROADS AND RUNWAYS

ground, and graders to smooth the surface. And then, enormous rolls of steel matting which were spread out to take the place of a concrete runway. In a very short time, almost a matter of hours rather than days, these trained and highly skilled engineers had turned a swamp into an airfield which was continuously serviceable, even though the Italian skies continued to pour down rain almost endlessly."

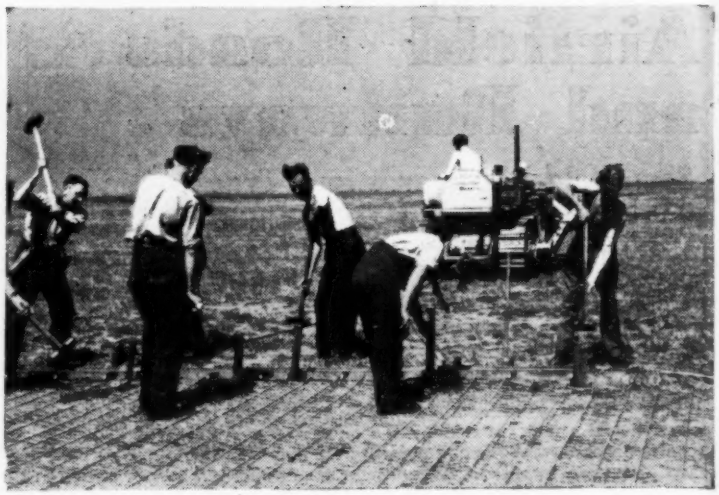
Flexible Duckboards

As a complement to the wire mat track, Somerfeld Flexboards have been introduced mainly as a means of providing an easily portable temporary road over virtually any type of ground. For construction jobs on airfields they are an ideal thing, and heavy lorries have been driven on Flexboards over grass runways with no wheel ruts or traces of damage being afterwards discernible.

Flexboards are made in 36in. and 42in. wide types respectively for the support of loads up to 10 tons and above 10 tons, the smaller type being composed of 1½in. boards and the larger type of 2in. boards. The principle is that of continuous, yet flexible, duckboarding; and as the Flexboards are made in individual lengths of about 9ft., they are very easily portable. There are 22 boards to each 9ft. unit, the boards varying in width between a 3in. minimum and a 6in. maximum. Boards are linked by 1¼in. × ¼in. mild steel ribbons on their upper and under surfaces at each end, each board being attached through the ribbons with ⅜in. diameter coach bolts, the ends of which are peened or burred over the nuts. For obvious reasons the nuts and heads of the bolts govern which side up the Flexboard units are to be laid.

The steel ribbons are run divergently in each 9ft. unit so that the closer spacing at one end can be fitted within the wider spacing at the end of the adjoining unit. Linkage is by means of 1in. nominal-bore heavy-gauge tubular hinge-pins which locate within the looped ends of the flexible ribbons. Picket pins to anchor the Flexboard units are driven into the ground through holes bored through each end of the hinge-pins.

As a means of extricating aircraft which have bogged down in heavy mud, Flexboards are probably unrivalled.



Two stages in the laying of a runway. The tractor pulls the wire taut while angle-iron pegs are driven in.

and they have certainly earned their laurels in the establishment of Allied bridgeheads where the provision of a roadway over soft sand, quicksand and mud has been a primary and vital necessity in getting our men and heavy equipment over and on to what is to become liberated territory.

WEST INDIANS JOIN R.A.F.

TWO thousand newly arrived "ambassadors" (as the Colonial Secretary called them)—R.A.F. recruits from the West Indies—are now in training at an Air Force station in Yorkshire. They are part of the first mass intake of men from those Colonies.

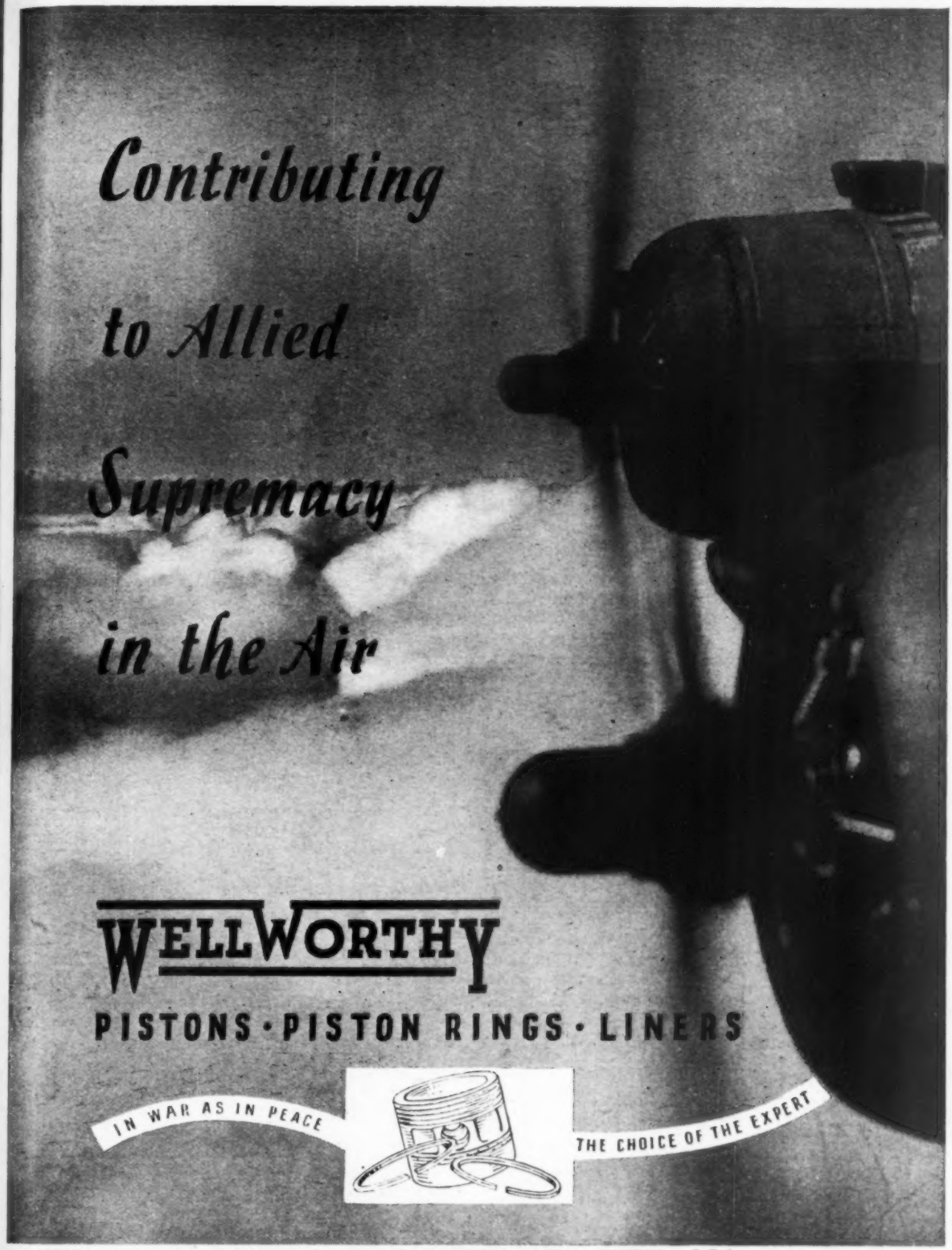
Hitherto, transport difficulties had been the only obstacle to many more West Indians volunteering earlier, though many worked their passage here as stokers to enlist. But when some time ago ships were available 2,000 men, mostly under 20, left college and office desks to realise their ambition of taking a direct part in the war. They have volunteered for ground duties and are qualifying as flight and motor mechanics, radio experts, cooks and clerks.

British officers and N.C.O.s are full of praise for the West Indians. "Quick to learn, intelligent and amenable to discipline, they are going to be good airmen," said one N.C.O.

Col. Oliver Stanley (Colonial Secretary) watched the recruits do physical training. Then he told them, "You have joined a force of great traditions. You will be fully worthy of those traditions. Many millions of people you have left behind will regard you as their ambassadors, their standard-bearers.

"Grave as are the perils and dangers we shall have to meet, it will not be long before you will be able to return to your homes, proud and satisfied at the part you have played in the victory we are going to win."

Their response was summed up by Winston Honeywell, 20-years-old school teacher from Kingston, who told a Press Association reporter: "We had to come. This is our war as it is yours."



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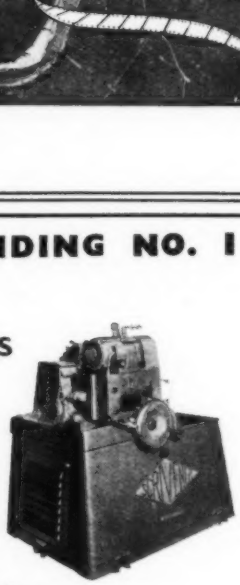

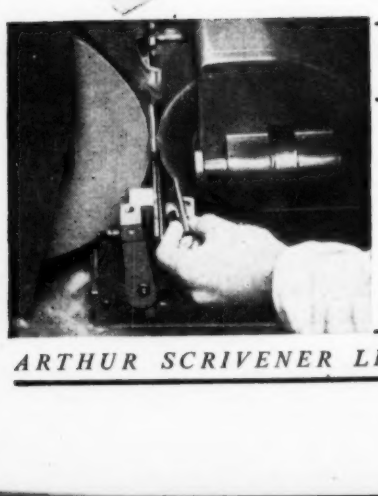

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M W.44

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers not necessarily for publication, must in all cases accompany letters.

EXHAUST-DRIVEN TURBINES

Fuel Wastage a Disadvantage

POOR old exhaust gas! Unsatisfied with having it for driving blowers, some would harness it to flaps and other things! (*Flight*, July 6th.)

Using it as a "pusher" seems to cause fuel waste for one thing.

Where is this Fifth Dimension? "VIEWER."

SORTING OUT THE SNAGS

Safe Seat or Fool's Paradise ?

I HAVE read with interest the correspondence published since the original article "Sorting out the Snags," written by "Indicator" and have come to the conclusion that there is a definite diversity of opinion regarding the safety of an aircraft, even when new.

I was previously under the impression that the system of control over manufacture, assembly and maintenance used in this country had eliminated any danger from the mechanical aspect, especially regarding the airframe and that Imperial Airways' reputation pre-war was largely a result of this control, coupled with efficient flight personnel, etc.

Is one to presume that what would appear to be a comfortable seat might in fact be a fool's paradise?

"DUBIOUS PASSENGER."

R.A.F.V.R. CLUB

An Organisation Already Exists

I READ with interest the letter by C. Smith in *Flight*, July 13th, regarding the formation of a club for deferred service airmen.

I would like to point out that there has been an organisation of this description in existence in this locality for over three years, which has been very successful in that it has had 60 per cent. of its ex-members appointed to commissioned ranks of aircrew in the R.A.F.

The aim of this club is to teach (by means of qualified instructors) the foundation of subjects necessary for *all* future aircrew personnel who are awaiting their re-call for training. We also hope to continue in the post-war world as a club for past members of aircrew.

We would, of course, like to see the movement extended to other areas and venture to suggest that any "deferred" airmen interested in doing this should write to the No. 1 Deferred Service Entrants' Club, Oval Road School, Oval Road, Croydon, and we will do all within our power to assist them in their aim.

P. FATHARLY,
(Hon. Chairman and Secretary.)

GUNPOWDER v. PETROL

Energy Proportional to Calorific Value

I WAS interested to read the letter from Mr. R. Davenport (*Flight*, June 29th) to which I might have replied sooner but for some minor disturbance to my personal property occasioned by the Hun's jet-propelled aerial torpedo which, be it noted, uses *petrol* and not gunpowder.

When dealing with the relative merits of petrol and gunpowder, which do their work by the expansion of highly heated gases, I submit that it is quite fallacious to subtract the volume of air used in the combustion of petrol from the volume of gases produced, reducing this to normal temperature and pressure, and then maintain that this is the volume of "propellant" gas produced. In fact, on this basis there would be no "propellant" gas at all, since at N.T.P. the H_2O would have condensed and the volume of exhaust gas, i.e. the CO_2 and nitrogen, is actually less than the amount of air required for combustion.

Those of us who have seen a buzz-bomb in flight at between 350 and 400 m.p.h. will acknowledge that petrol really must produce considerable "propellant" gas, whereas to apply Mr. Davenport's argument it presumably should, after being catapulted from its emplacement, recoil gently backwards into the launching crew! Desirable as this might be, the facts belie such a theory.

It is an established scientific fact that the amount of energy that can be obtained from a given weight of a combustible substance is roughly proportional to its calorific value. Explosives carry a very heavy penalty in this respect because they have to contain in solid form the oxygen (and usually nitrogen as well) necessary to ensure instantaneous combustion of the entire quantity present, whereas with petrol the oxygen is collected from the air *en route*. The calorific value of 1 lb. of gunpowder is only one-fifteenth that of an equal weight of petroleum; I very much doubt if any "modern organic gunpowder," as mentioned by Mr. Davenport, and which it might be practicable to use, would approach within even one-tenth of the calorific value of petroleum.

A. R. OGSTON.

POWER OUTPUT

Racing v. Service Requirements

MAY I be permitted to answer Musharaph's letter (*Flight*, July 6th) about racing engines? The Fiat engine in the Macchi-Castoldi racer was, in fact, two separate V-12 engines together driving a pair of contra-rotating airscrews. Surely to-day it is not uncommon for twin engines to develop a total of 2,800 h.p.? The striking thing about this was the tandem position of the engines in the fuselage, thus considerably reducing drag. For Service aircraft, however, this would present several great drawbacks, such as position of cockpit, radio and accessories and stresses during violent manœuvres, which the racer would not be called upon to perform.

The Rolls-Royce "R" engine is a slightly different case. This was a single V-12 type, incidentally of the same cylinder dimensions as the modern Griffon engine. This engine had been specially tuned to give its full power at a very low altitude and for one very short period only. Fuel consumption during this period was undoubtedly extremely high. Under Service conditions maintenance would be very difficult and the pitch of tuning, once obtained, could not be kept up. Cooling would be almost impossible: the S-6B had cooling surfaces, so vulnerable that they could be damaged by touch of hand, covering fuselage sides, wings and floats. A modern engine for Service aircraft, on the other hand, must be able to run without major overhaul for many hundreds of hours. There is no saying, however, whether some Service type of power unit has not been, or is not being, developed which exceeds the "R" engine's power.

F. J. HEYMANN.

"RETREAT TO RATIONALISM"

Why Not Diesel-engined Flying Boats ?

"INDICATOR," in his article "Retreat to Rationalism" (*Flight*, July 6th) is absolutely right in pointing out that aircraft engines and flying machine contraptions with their numerous auxiliaries, gadgets, etc., are altogether overdone and have brought the modern machine up to such a pitch of complication as to make it entirely uneconomical from a commercial point of view.

He is also right when he says: "I sometimes think it will be necessary to go right back and start again." Yes, it is absolutely certain that airline companies will never make a paying proposition out of the present-day machine because its inspection requirements would be enormous and its petrol consumption, which, incidentally, is 25 per cent. of the total running cost, would be unthinkable.

The price of high-octane petrol is also prohibitive, and the fire risk entailed therewith rules it out altogether for commercial use.

If the M.A.P. will study the diesel aircraft engine and encourage aircraft engine builders to improve their designs with experimentation, they will find that it is altogether a better engine than the petrol engine for commercial use, considering it uses a third less fuel than the petrol engine and the price of the fuel is about a quarter the price of petrol.

It also has no fire risk, no valves and no electrical ignition, and the weight per h.p. for the 2,000 h.p. design is only 1.1 lb.

Now let me quote "The Modern Diesel" *Iliffe & Sons, Ltd.*: "Consequently for short range the petrol engine and its fuel weigh less than the diesel and its oil fuel, but when long distances are considered, the diesel, due to its economy of consumption, scores in the matter of weight." This is referring

CORRESPONDENCE

to the Junkers Jumo 720 h.p. engine of 2 lb./h.p. which Germany is now fitting to their giant Blohm and Voss flying boat of six engines (see *Flight*, May 4th.)

Again, flying-boat construction does away with undercarriage complications and weight.

It is obvious, I think, from these few remarks, that a very economical machine can be constructed for commercial purposes if the diesel engine were available in this country. Why should it not be available, and who has condemned it? It was being built by Napiers in this country before the war. It is the ideal engine for long-distance work and ease of servicing, besides being more reliable.

The economical machine should also cruise at about 175 m.p.h. with a landing speed of about 65 m.p.h. for safety. Extremely high speeds are not desirable or wanted by the public; only by schoolboys.

If airline companies were to copy the railway companies' organisation and system of drawing up a specification of the aircraft they require for commercial and economic purposes, for the manufacturer to comply with and tender for, they would then get a machine of minimum complications and maximum economy all round.

On the other hand, if design is left entirely to the manufacturer he will naturally make the machine as expensive and complicated as possible so that he will have a good demand for spares and whack up a big initial price, which, after all, is only business and human nature.

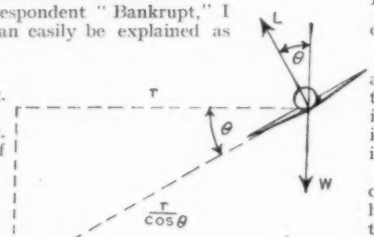
Railway companies always design their own locomotives and rolling stock, and in some cases do their own manufacture, which they find more convenient and economical!

J. R. GOULD (Maj.).

ANGLES OF BANK

Mathematical Demonstration

IN reply to your correspondent "Bankrupt," I think his problem can easily be explained as follows:—



Let L poundals be lift.
W poundals be weight.
v ft./sec. be speed.
r ft. be radius of turn.
w rad/sec. be rate of turn.
θ be angle of bank.

Then
$L \cos \theta = W$
and $L \sin \theta = \frac{W}{g} \frac{v^2}{r}$

$\therefore \frac{w}{\cos \theta} \sin \theta = \frac{w}{g} \frac{v^2}{r}$

$\therefore \tan \theta = \frac{v^2}{gr} = \frac{v^2}{g} \frac{w}{v}$ since $r = \frac{v}{w} = \frac{vw}{g}$ .....(i)

i.e., for a definite speed and rate of turn there is a definite angle of bank irrespective of the weight or wing loading of the aircraft. Of course the aircraft of higher wing loading would fly at the greater angle of attack. Incidentally I have taken w as the true rate of turn about a vertical axis, not the indicated rate of turn (about an axis perpendicular to the plane of the aircraft). If w' is the indicated rate of turn:—

$$w' = \frac{v}{\left(\frac{r}{\cos \theta}\right)} = w \cos \theta$$

$$\therefore \sin \theta = \frac{v w'}{g} \quad \text{.....(ii)}$$

It will be seen that our deduction from (i) still applies to (ii).

Hoping this is clear,

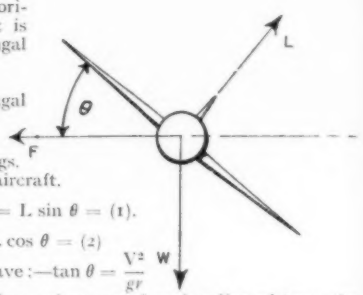
Yours truly,

ZEROX.

— and Again

WITH reference to the question asked by "Bankrupt" in the July 13th issue of *Flight*, the following is the simple theory which may help him.

When an aircraft is turning there must be a centripetal force acting on the aircraft, i.e. a force towards the centre of the turning circle, equal and opposite to the centrifugal force. In order that there shall be no sideslip, the aircraft is banked until the horizontal lift component is equal to the centrifugal force.



From diagram.
L Let F = centrifugal force = $\frac{WV^2}{gr}$
W L = lift on wings.
W = weight of aircraft.

Resolve Horiz: $\frac{WV^2}{gr} = L \sin \theta = (1)$.

Resolve Vert: $W = L \cos \theta = (2)$

dividing (1) by (2) we have:—$\tan \theta = \frac{V^2}{gr}$

Which proves that for a given speed and radius of turn, the angle θ is constant. It will be seen from the diagram that if the angle of bank is too small then the horizontal lift component is insufficient and the aircraft will sideslip outwards. Similarly if the angle of bank is too great, then the aircraft will sideslip inwards.

A point worth noting in passing is that, while turning the outer wing is moving faster than the inner one, and therefore has a greater lift. Therefore there is a turning moment tending to overbank the plane due to the difference of the lift on each wing. Hence, when the turn has been completed, it is necessary to reverse the ailerons, which is known as "holding off" the bank.

E. AUBREY.

These two letters on Angles of Bank are representative of a large number received dealing with the same subject.

NORMANDY BEACHHEAD MORE PEACEFUL THAN SOUTHERN ENGLAND

"THE anti-aircraft barrage over the beaches in Normandy is so intense that German aircraft get nowhere near them during the day," said Col. Walter B. Goodrich, U.S. Army anti-aircraft expert, who for three weeks has been studying the beach barrage for the U.S. War Department Observation Board.

"It's more peaceful there than right now in London and Southern England," he told Reuter's Special Correspondent. "We have an astounding number of guns over there."

Over 100 German aircraft have been shot down, mostly at night, by the American beach barrage, which is so fierce that it is calculated that for each aircraft destroyed 800 rounds are fired by the heavier guns and 20,000 by machine guns.

The first American anti-aircraft units landed on their beaches a few minutes after the first assault troops had gone in. They were faced with heavy fire, but the air cover was so excellent that, in the early stages, their guns were used as field artillery to assist the consolidation of the beachhead.

Col. Goodrich said that co-operation with the Allied fighters both day and night was first-class. "It is largely due to the wonderful team work between the Air Force and the anti-aircraft that the *Luftwaffe* has been kept away."

During the first month of the invasion Allied aircraft losses totalled 1,284 aircraft. The Germans, lost 1,067, excluding those destroyed or damaged on the ground.

Although Allied losses are higher, the percentage in relation to sorties is extremely low, and it was stated at SHAEF that the German percentage must be "much higher," though it is impossible to be precise.

In approximately 158,000 sorties from Britain and the Normandy airfields embodying operational missions of all types—tactical support of the battle, strategic attacks on industries in Germany and German occupied Europe, and defensive patrols and reconnaissance—just over 0.8 per cent. of Allied aircraft were lost. The percentage figure has actually decreased gradually since the initial phase, when it slightly exceeded 1 per cent.

There is nothing surprising about the lowness of Allied losses in relation to the sorties flown. It is merely convincing proof of the overwhelming Allied superiority in the air.

Detailed figures for the different air commands are as follow:

U.S. Ninth Air Force: 38,000 sorties, 207 claims, 317 losses.

R.A.F. Second T.A.F.: 36,000 sorties, 245 claims, 269 losses.

A.D.G.B.: 21,000 sorties, 134 claims, 49 losses.

R.A.F. Bomber Command: 10,500 sorties, 109 claims, 216 losses.

U.S. Eighth Air Force: Heavy bombers: 27,500 sorties, 55 claims, 218 losses.

U.S. Eighth Air Force: Fighters: 25,500 sorties, 317 claims, 215 losses.

NAVY'S SHARE : A Fleet Air Arm Wildcat operating with the Allied Expeditionary Air Force.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Promotion

GENERAL DUTIES BRANCH.

Air Comdre. (temp.) (Act. Air Vice-Marshal) B. E. EMBRY, D.S.O., A.F.C., is granted the rank of Air Comdre. (war subs.). June 1st, 1944.

Retirements

GENERAL DUTIES BRANCH.

THE following officers have reverted to the retired list at their own requests :—

Air Vice-Marshal Sir Arthur M. LONGMORE, G.C.B., D.S.O., reassuming the substantive rank of Air Marshal and retaining the rank of Air Chief Marshal. June 1st, 1944.

Group Capt. C. H. ELLIOTT-SMITH, A.F.C., retaining the rank of Air Comdre. June 12th, 1944.

Wing Cdr. T. H. ENGLAND, D.S.C., A.F.C., retaining the rank of Group Capt. June 14th, 1944.

The following officers are placed on the retired list :—

Air Vice-Marshal R. E. SAUL, C.B., D.F.C. June 29th, 1944.

Air Comdre. G. B. DACRE, C.B.E., D.S.O. June 26th, 1944.

Group Capt. (temp. Air Comdre.) W. H. DUNN, C.B.E., D.S.C., retaining the rank of Air Comdre. June 29th, 1944.

Wing Cdr. (temp. Group Capt.) H. A. HAMMERSLEY, M.C., retaining the rank of Group Capt. June 13th, 1944.

Wing Cdr. (temp. Group Capt.) W. K. MERCER, retaining the rank of Group Capt. June 21st, 1944.

Awards

Fleet Air Arm

THE KING has been graciously pleased to approve the following awards :—

M.B.E. (Mil.)

For outstanding skill and ability as Flight Deck Officer in H.M.S. *Emperor* during successful attacks on enemy shipping in Northern Waters :—

Temp. Lt. (A) D. C. HILL, R.N.Z.N.V.R.

For gallant and distinguished services :—

Temp. Lt. (A) S. W. L. CAMPBELL, R.N.V.R.

Distinguished Service Cross

For outstanding services in H.M. Ships *Emperor* and *Striker* in operations against enemy shipping in Northern Waters :—

Temp. Sub. Lt. (A) T. H. HOARE, R.N.Z.N.V.R.

Wing Cdr. R. D. Max, D.F.C., who has been awarded the D.S.O. His citation appears on this page.

For undaunted courage, skill and devotion to duty while serving in, or operating from, H.M. Ships *Activity*, *Fencer*, *Keppel*, *Saumarez*, *Starling* and *Tracker* in the escort of convoys to and from North Russia in the face of determined attacks by U-Boats :—

Act. Temp. Lt. Cdr. (A) J. G. LARGE, R.N.V.R.
Temp. Lt. (A) S. BRILLIANT, R.N.V.R.
Temp. Lt. (A) G. B. C. SANGSTER, R.N.V.R.
Temp. Lt. (A) J. E. SCOTT, R.N.V.R.
Temp. Lt. (A) J. S. TONER, R.N.V.R.
Temp. Lt. (A) G. R. WILLCOCKS, R.N.V.R.
Temp. Sub. Lt. (A) H. CHADWICK, R.N.V.R.
Temp Sub. Lt. (A) R. A. WOODWARD, R.N.V.R.

Distinguished Service Medal

Temp. Act. Pet. O. (A) J. PERRY.
Temp. Ldg. Airman J. A. GREENFIELD.

Royal Air Force

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations :—

Distinguished Service Order

Act. Wing Cdr. R. D. MAX, D.F.C., R.N.Z.A.F., No. 75 (N.Z.) Sqn.—This officer has displayed exceptional skill, great drive and outstanding devotion to duty, qualities which have contributed in a large measure to the high standard of operational efficiency of the squadron he commands. He has completed a very large number of sorties and his fine leadership, high courage and unbeatable determination have greatly inspired his crews. His example has been of a high order.

Bar to Distinguished Flying Cross

Act. Flt. Lt. H. D. CHURCHILL, D.F.C., R.A.F.V.R., No. 156 Sqn.—This officer and airman were pilot and flight engineer respectively of an aircraft which attacked Karlsruhe one night in April, 1944. Soon after the bombs had been released the aircraft sustained damage to both wings, the flaps and one of the petrol tanks, from which a considerable amount of the contents was lost, and a fire started close to the rear turret. Flt. Lt. Churchill had great difficulty in maintaining control of the aircraft. Nevertheless, he continued to give directions for fighting the fire, a task which Flt. Sgt. Meer gallantly attempted.

SERVICE AVIATION

The flames increased in intensity, but, although distressed by petrol fumes and deprived of the full use of oxygen, Flt. Sgt. Meer worked unremittingly and finally succeeded in putting out the fire. After a hazardous flight, Flt. Lt. Churchill eventually landed the badly damaged bomber at an airfield in England. He displayed skill, determination and devotion to duty beyond praise. Flt. Sgt. Meer also proved himself to be a most dependable member of aircraft crew. His coolness and bravery in a trying situation set a fine example.

Act. Sqn. Ldr. H. T. MILES, D.F.C., R.C.A.F., No. 408 (R.C.A.F.) Sqn.—This officer, now on his second tour of operational duty, has taken part in a large number of sorties, including attacks against some of the enemy's most distant and heavily defended targets. An outstanding captain of aircraft, he has always performed his duties in a cheerful and efficient manner, while as a flight commander Sqn. Ldr. Miles has led his formation with determination, skill and courage.

Distinguished Flying Cross

Act. Group Capt. A. A. ADAMS, R.A.F., No. 49 Sqn.
Act. Wing Cdr. J. SIMPSON, R.A.F.V.R., No. 97 Sqn.
Act. Sqn. Ldr. E. J. CHIDGEY, R.A.F.V.R., No. 35 Sqn.
Act. Sqn. Ldr. B. M. MATHERS, R.A.F., No. 156 Sqn.
Act. Sqn. Ldr. A. J. PUTNAM, R.A.F.V.R.
Flt. Lt. N. H. FREDMAN, R.A.F.V.R., No. 109 Sqn.
Flt. Lt. C. J. GINDER, R.A.F.V.R., No. 106 Sqn.
Flt. Lt. H. T. JOHN, R.A.F.V.R., No. 192 Sqn.
Flt. Lt. H. L. MCCARTHY, R.A.F.V.R., No. 207 Sqn.
Flt. Lt. W. A. WILLIAMSON, R.A.F.V.R., No. 106 Sqn.
Act. Flt. Lt. P. A. CUNNINGHAM, R.A.F.V.R., No. 50 Sqn.
Act. Flt. Lt. D. U. GIBBS, R.A.F.V.R., No. 106 Sqn.
Act. Flt. Lt. R. A. WALKER, R.A.F.V.R., No. 83 Sqn.
F/O. D. H. ACWORTH, R.A.F.V.R., No. 627 Sqn.
F/O. J. BARR, R.A.F.V.R., No. 61 Sqn.
F/O. A. H. BIGNELL, R.A.F.V.R., No. 50 Sqn.
F/O. J. BINHAM, R.A.F.V.R., No. 51 Sqn.
F/O. J. A. BRADWELL, R.A.F.V.R., No. 192 Sqn.
F/O. P. W. BUTTLE, R.A.F.V.R., No. 617 Sqn.
F/O. C. F. A. CLOTHIER, R.A.F.V.R., No. 101 Sqn.
F/O. H. B. COOPER, R.A.F.V.R.
F/O. D. L. CRAMP, R.A.F.V.R., No. 106 Sqn.
F/O. R. A. HINCKLEY, R.A.F.V.R., No. 106 Sqn.
F/O. J. S. MIDDLEMISS, R.A.F.V.R., No. 78 Sqn.
F/O. F. M. MIFFLIN, R.A.F.V.R., No. 106 Sqn.
F/O. J. T. MILLER, R.A.F.V.R., No. 640 Sqn.
F/O. H. R. MOSSOP, R.A.F.V.R., No. 50 Sqn.
F/O. K. J. NOTT, R.A.F.V.R., No. 192 Sqn.
F/O. K. W. ODGERS, R.A.F.V.R., No. 50 Sqn.
F/O. J. E. R. REES, R.A.F.V.R., No. 463 (R.A.A.F.) Sqn.
F/O. A. E. RICHARDS, R.A.F.V.R., No. 627 Sqn.
F/O. C. O. RUSSELL, R.A.F.V.R., No. 51 Sqn.
F/O. B. T. SALVONI, R.A.F.V.R., No. 640 Sqn.
F/O. G. G. TAYLOR, R.A.F.V.R., No. 619 Sqn.
F/O. R. M. WELLER, R.A.F.V.R., No. 640 Sqn.
F/O. T. WILKIE, R.A.F.V.R., No. 619 Sqn.
F/O. D. A. PAGLILERO, R.A.F.V.R., No. 106 Sqn.
P/O. E. K. ALLEY, R.A.F.V.R., No. 619 Sqn.
P/O. D. ANDREW, R.A.F.V.R., No. 49 Sqn.
P/O. K. H. BLACKHAM, R.A.F.V.R., No. 49 Sqn.
P/O. R. M. CHESSWASS, R.A.F.V.R., No. 78 Sqn.
P/O. F. G. HAYLER, R.A.F.V.R., No. 9 Sqn.
P/O. P. J. MOYES, R.A.F.V.R., No. 156 Sqn.
P/O. J. R. SANDS, R.A.F.V.R., No. 78 Sqn.
P/O. P. E. THOMPSON, R.A.F.V.R., No. 50 Sqn.
P/O. G. A. TURNBULL, R.A.F., No. 61 Sqn.
Act. Flt. Lt. D. T. CONWAY, R.A.A.F., No. 467 (R.A.A.F.) Sqn.
Act. Flt. Lt. V. E. R. PIPER, R.A.A.F., No. 105 Sqn.
Act. Flt. Lt. A. E. VOWELS, R.A.A.F., No. 463 (R.A.A.F.) Sqn.
Act. Flt. Lt. F. B. M. WILSON, R.A.A.F., No. 463 (R.A.A.F.) Sqn.
F/O. W. H. BROOKER, R.A.A.F., No. 463 (R.A.A.F.) Sqn.
F/O. P. H. SWAN, R.A.A.F., No. 139 Sqn.
P/O. R. T. BOULTBEE, R.A.A.F., No. 619 Sqn.
P/O. C. A. HAIGH, R.A.A.F., No. 61 Sqn.

Distinguished Flying Medal

Flt. Sgt. G. MEER, R.A.F.V.R., No. 156 Sqn.—For citation see Act. Flt. Lt. CHURCHILL, D.F.C. and Bar.
Flt. Sgt. C. L. ALLIKER, R.A.F.V.R., No. 51 Sqn.
Flt. Sgt. R. APPEYARD, R.A.F.V.R., No. 106 Sqn.
Flt. Sgt. W. H. BARKER, R.A.F.V.R., No. 44 Sqn.
Flt. Sgt. C. BENTHAM, R.A.F.V.R., No. 156 Sqn.
Flt. Sgt. E. N. BICKLEY, R.A.F.V.R., No. 156 Sqn.
Flt. Sgt. N. H. BOYD, R.A.F.V.R., No. 138 Sqn.
Flt. Sgt. C. A. BRYANT, R.A.F.V.R., No. 166 Sqn.
Flt. Sgt. J. W. CLARK, R.A.F.V.R., No. 166 Sqn.
Flt. Sgt. J. CLYDE, R.A.F.V.R., No. 10 Sqn.
Flt. Sgt. W. G. DAY, R.A.F.V.R., No. 76 Sqn.
Flt. Sgt. K. A. DRURY, R.A.F.V.R., No. 100 Sqn.
Flt. Sgt. J. GOLDING, R.A.F.V.R., No. 35 Sqn.
Flt. Sgt. A. J. GURR, R.A.F.V.R., No. 44 Sqn.
Flt. Sgt. F. L. HIGGINS, R.A.F.V.R., No. 106 Sqn.
Flt. Sgt. B. W. HILL, R.A.F.V.R., No. 101 Sqn.
Flt. Sgt. N. J. HORSLEY, R.A.F.V.R., No. 50 Sqn.
Flt. Sgt. P. A. HUGHES, R.A.F.V.R., No. 51 Sqn.
Flt. Sgt. B. L. I. JOHNSON, R.A.F.V.R., No. 156 Sqn.

Roll of Honour

Casualty Communiqué No 406.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list 101 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. F. Ashbee; Sgt. J. Atkinson; Sgt. J. B. Baskerville; Sgt. J. S. Beeley; Sgt. D. A. Bennett; Sgt. V. R. Chadwick; Sgt. W. Clarke; Sgt. D. J. Corlyon; Sgt. G. H. Evans; Flt. Lt. G. W. Harrison; Flt. Sgt. B. E. Hart; Sgt. A. F. Langridge; Flt. Sgt. R. C. McIntyre; Flt. Sgt. J. E. Maddox; Sgt. J. C. W. Martin; Sgt. W. L. Murphy; Flt. Sgt. H. E. G. Pugh; Sgt. J. W. H. Rimmer; F/O. A. Smith.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. D. H. Bentley; P/O. A. R. Bonnick; Sgt. V. H. Causeway; Sgt. T. W. Davis; Sgt. A. W. Franklin; Sgt. G. Morrison.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/t. Sgt. D. Adams; Sgt. W. G. Addison; Sgt. A. Bain; Flt. Lt. P. J. Blurton, D.F.C.; Sgt. H. Booth; Sgt. G. T. Boswell; Sgt. J. Cahill; Sgt. J. B. Cameron; Sgt. W. A. Casell; Sgt. M. E. Cipriani; Sgt. E. Clayton; W/O. E. J. Clinch; Sgt. E. H. Cuff; Sgt. G. P. Finlay; P/O. A. M. Fitzgerald; Sgt. R. G. C. Forbes; Sgt. J. Goodwin; Sgt. C. W. Gray; Sgt. M. Gray; Sgt. M. Griffiths; Sgt. R. T. Hampton; Sgt. S. D. Harris; Sgt. W. Hazlley; Flt. Sgt. W. A. Hebden; P/O. H. C. Hoyne; Sgt. N. W. Jewell; Sgt. D. H. Kealey; Flt. Sgt. N. Kendall; P/O. K. R. Lee; P/O. B. H. Marshall; P/O. B. F. H. Miller; Sgt. S. J. Mitchell; Sgt. C. Munro; Sgt. J. C. B. Parkinson; F/O. P. S. Porteous; Sgt. C. H. Pratt; Sgt. S. Preston; Sgt. L. T. Reynolds; Sgt. A. J. G. Richards; Sgt. B. H. Ruddy; Sgt. J. Seddon; Sgt. M. Sheedy; P/O. A. R. G. Small; Sgt. C. L. Spink; Sgt. H. A. Toomey; Sgt. A. H. Whetton; Sgt. C. H. M. Wilson; Sgt. D. G. Woolcott.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—Sgt. K. E. Goodsell.

WOUNDED OR INJURED IN ACTION.—Sgt. D. Barber; Flt. Sgt. P. Senior; Sgt. J. D. G. Taylor.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. W. Fyfe.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. W. G. Ault; Sgt. J. Ensor; Flt. Sgt. M. Kerr; W/O. I. W. Marshall; P/O. W. Shaw; F/O. G. H. Williams.

MISSING.—Flt. Sgt. L. E. Amos; Flt. Sgt. H. I. Austin; Flt. Sgt. E. R. N. Barrell; Sgt. J. Belton; Sgt. E. A. Bland; Flt. Sgt. H. Bossick; Sgt. J. B. Bowen; Sgt. D. G. N. Boyce; Flt. Sgt. R. Brookes; Flt. Sgt. M. G. Brown; Sgt. T. J. Burleigh; Flt. Sgt. R. D. Casajuana; F/O. F. Chadwick; F/O. P. E. Chilman; Sgt. C. Christie; Flt. Sgt. L. Clay; Sgt. R. B. Corkill; Sgt. J. Coulter; F/O. D. H. Courtenay; Act. Wing Cdr. A. G. S. Cousens, D.S.O., D.F.C.; Sgt. K. J. Cresswell; F/O. G. H. Cruwys; Sgt. W. H. Dean; Sgt. N. J. J. Dobson; Flt. Sgt. H. Dolby; F/O. W. Eaton; F/O. A. C. Elliott; Sgt. M. P. Fenton; P/O. G. W. Fernyhough; P/O. H. H. J. Fisher; Sgt. E. J. Fletcher; Flt. Sgt. W. B. Fothergill; Flt. Sgt. D. A. Fraser; Sgt. R. W. French; Flt. Sgt. R. Gardner; Sgt. J. W. Germing; Sgt. W. J. Gilchrist; Sgt E. A. Goss; Flt. Sgt. H. Grainger; W/O. E. W. Green; Flt. Sgt. R. L. Griffiths; W/O. T. Grynkiewicz; Sgt. R. H. Hall; Flt. Sgt. E. Hambling; W/O. J. R. Hanson; Sgt. L. Hanson; Flt. Sgt. O. S. Harvey; Sgt. W. Healier; Sgt. P. K. Heller; Flt. Sgt. W. Hewitt; Flt. Sgt. E. F. Hill-Cottingham; Flt. Sgt. R. Holmes; Sgt. A. Howcroft; Flt. Sgt. N. H. Johnson; Flt. Sgt. A. T. Jones; Flt. Sgt. A. H. J. Jordan; Sgt. D. W. Keenan; Sgt. J. Kenyon; Act. Sqn. Ldr. E. W. Kinchin; Sgt. T. Kirby; Sgt. L. E. Lamb; Flt. Sgt. F. W. Lambert; Sgt. P. Latchford; Act. Sqn. Ldr. D. Leatherland; Act. Flt. Lt. J. H. S. Lee; Sgt. W. Lee; W/O. R. Lilley, D.F.C.; Act. Sqn. Ldr. V. C. Lovell, D.F.C.; Sgt. W. H. Lynch; Sgt. J. McAllister; P/O. I. H. McDowell; Sgt. D. Mackay; Act. Sqn. Ldr. D. W. Mansbridge, A.F.C.; Flt. Sgt. J. R. Mantle; P/O. T. G. Marsh; Flt. Sgt. W. P. Mead; F/O. F. M. Mifflin; F/O. D. F. Minns; Flt. Lt. E. Mirfin; Sgt. T. Monteith; Sgt. J. G. Morris; W/O. G. Muckart; Sgt. L. Murphy; Sgt. A. R. Newell; W/O. A. S. Palmer; Sgt. W. R. Percival; Flt. Sgt. R. G. Pile; Flt. Sgt. J. Pinkney; Sqn. Ldr. C. W. Poulter; Sgt. D. K. Ray; Sgt. D. F. Rimmer; Sgt. G. A. Robinson; Sgt. J. Robinson; Flt. Lt. D. L. Sedgwick; Flt. Lt. D. Sellors; Flt. Sgt. C. Shackleton; Sgt. D. B. Sheehan; Flt. Sgt. S. J. Shepherd; Sgt. H. W. L. Smith; Sgt. P. C. Smith; Sgt. R. E. Smith; Sgt. D. E. Spencer; Flt. Sgt. M. C. Spice; Flt. Sgt. F. Taylor; Sgt. K. V. F. Terry; Sgt. S. L. Thompson; P/O. J. L. Tucker; Sgt. A. Walker; Sgt. L. Walters; Sgt. G. H. Warren; Sgt. I. Welch; W/O. W. C. White; W/O. A. Whitehouse; Sqn. Ldr. P. M. Wigg; F/O. K. F. H. Wright; Flt. Sgt. E. O. D. Yorke.

KILLED ON ACTIVE SERVICE.—Flt. Lt. E. Alderson; F/O. J. A. Banks; F/O. E. M. Barrett; P/O. J. G. Brown; Sgt. L. Burman; Flt. Sgt. J. W. Carr; Flt. Sgt. J. B. Clelland; Sgt. A. Graham; Sgt. R. C. Holmwood; Sgt. P. B. Illingworth; F/O. H. P. H. Kiddle; P/O. A. MacP. Lees; P/O. P. A. Leins; Sgt. P. E. Lomas; F/O. H. E. McCann; Act. Flt. Lt. J. J. S. Mellar; Sgt. T. Mitchell; P/O. G. D. Morris; F/O. M. P. O'Keeffe; Flt. Lt. J. C. Paterson; Sgt. J. E. Rowley; Sgt. N. Skirrow; Flt. Sgt. S. Stringer; Sgt. R. J. Uden; Flt. Sgt. A. J. B. Wayman.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. D. E. Welch.

DIED ON ACTIVE SERVICE.—L.A/C. E. R. Aylett; L.A/C. J. R. Gould; Cpl. L. J. E. Lysaght.

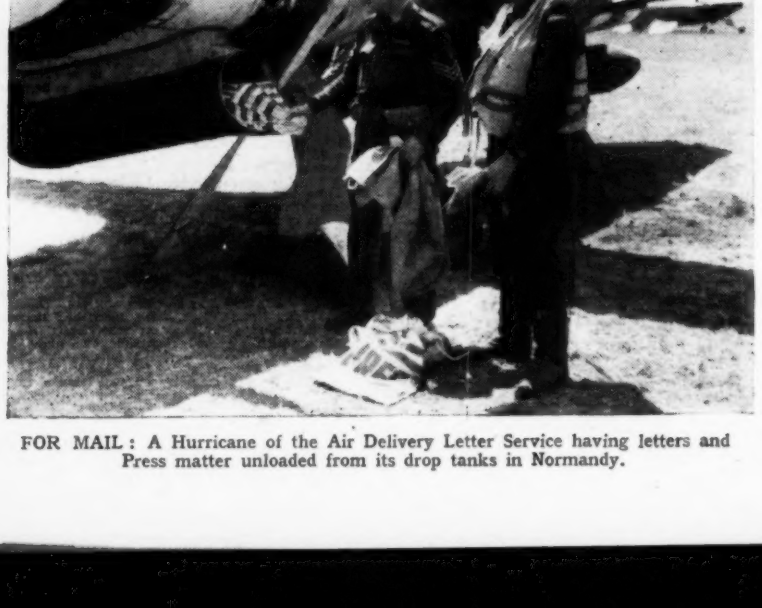
PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. V. Clayson; Flt. Sgt. L. W. Davey; Sgt. R. Henderson; F/O. S. H. James; Flt. Sgt. N. J. Martin; Sgt. T. B. Semple; P/O. R. V. Weller.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. A. A. Cranfield; Flt. Sgt. K. C. French; Flt. Sgt. K. R. Galt; F/O. E. A. Harris; Flt. Sgt. H. K. Lucy; Flt. Sgt. G. A. Lynch; F/O. H. J. McCulloch; Flt. Sgt. R. A. Nield; Flt. Sgt. E. M. Sibbitt; P/O. C. K. Smith; F/O. M. T. L. Watson; F/O. J. R. Welch.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. W. M. Cashman; Flt. Lt. M. C. S. Hayes; F/O. W. N. T. Russell, D.F.C.

MISSING.—Flt. Sgt. R. Allen; F/O. P. R. Callahan; P/O. G. G. Foulkes; P/O. G. B. Hall; Flt. Sgt. V. K. Lewis; F/O. J. S. Pritchard; F/O.



FOR MAIL: A Hurricane of the Air Delivery Letter Service having letters and Press matter unloaded from its drop tanks in Normandy.

J. W. Sharpe; F/O. R. Sigmont; F/O. A. K. Steinbeck; Flt. Sgt. W. J. Struthers; Flt. Sgt. W. J. Theyer; Act. Sqn. Ldr. J. H. Trobe, D.F.C.
KILLED ON ACTIVE SERVICE.—Sgt. W. J. Poling.
DIED ON ACTIVE SERVICE.—P/O. G. C. Scott.

Royal Canadian Air Force

KILLED IN ACTION.—W/O. H. Bennis; W/O. R. A. Gerrard.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—W/O. C. C. McDougall.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. T. N. Bain; F/O. A. J. F. Hay; P/O. R. L. Le Roux; W/O. B. E. Mitchell; Act. Flt. Lt. W. J. Sibbald, D.F.C.; F/O. R. Stewart.
MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. L. D. Thomas.
MISSING.—W/O. A. Achtymichuk; Sgt. W. R. Adlard; W/O. D. S. Brillinger; W/O. J. P. G. Brisson; Sgt. B. O. Brophey; Flt. Sgt. F. L. Bulman; W/O. F. P. Cammaart; Sgt. P. B. Crosswell; W/O. J. E. L. Davidson; F/O. J. Y. Desrosiers; Flt. Sgt. H. W. Doiron; F/O. A. A. H. J. N. Duchesnay; F/O. J. F. Fennessey; F/O. B. C. E. Fortin; Sgt. S. Glaister; Flt. Sgt. F. Hatchman; Sgt. J. F. R. Hurteau; F/O. G. P. Kinnear; F/O. H. K. Langrish; Sgt. J. H. C. Legault; Flt. Sgt. J. S. Laird; Sgt. R. L. Lochhead; Flt. Sgt. N. H. Lynch; P/O. R. V. McDougall; F/O. P. G. H. MacGregor; P/O. A. J. McPhee; Sgt. J. L. Priamo; Sgt. J. J. Renning; Flt. Sgt. E. A. Rhoades; F/O. H. D. Thomas; W/O. W. F. Vornbrock; Sgt. J. O. Young.
KILLED ON ACTIVE SERVICE.—P/O. R. G. C. Brodie; Sgt. N. H. B. Garrity; W/O. K. W. Norfolk; Sgt. A. L. Stoneham.
PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—W/O. R. T. Currie.
DIED ON ACTIVE SERVICE.—Flt. Lt. C. O. Baker.
PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—P/O. W. A. Grant; Flt. Sgt. J. L. Keighan.

Royal New Zealand Air Force

KILLED IN ACTION.—Act. Flt. Lt. C. Eddy.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. F. Bowman; Flt. Sgt. L. J. Frost; F/O. I. Marinovich; Flt. Sgt. T. J. Soper; F/O. L. A. Trigg, D.C., D.F.C.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. R. G. Boyd; P/O. F. D. Clark; Flt. Sgt. R. J. Farrelly; P/O. R. J. Mosen; Flt. Sgt. A. M. Reid; Flt. Sgt. N. C. Rollett; F/O. A. B. Wallis; F/O. J. Whyte.
MISSING.—F/O. H. J. Drawbridge; F/O. J. L. Funnell; P/O. G. D. Heathcote; Flt. Sgt. M. R. Henderson; F/O. R. W. Herron; F/O. E. W. McLachlan; F/O. A. R. Oates; W/O. K. A. Smith.
KILLED ON ACTIVE SERVICE.—W/O. N. G. Hickmott; W/O. T. C. Hosken.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. H. Harries.

South African Air Force

KILLED IN ACTION.—Capt. H. E. Rogan.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Lt. M. H. Davids; Lt. M. Isenberg.
WOUNDED OR INJURED IN ACTION.—Lt. H. P. Freeman.
MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—2/Lt. C. A. Wright.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—2/Lt. K. P. Caine.

Casualty Communiqué No. 407

Of the names in this list, 104 are second entries giving later information of casualties published in earlier lists

Royal Air Force

KILLED IN ACTION.—Sgt. S. Crook; Flt. Sgt. A. Jones; Sgt. W. C. McKay; Flt. Sgt. W. F. Mitchell; Sgt R. Partington; W/O. K. E. Robinson; Sgt. J. F. Willis.
PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. D. W. Brookes; Flt. Sgt. J. H. Frewer; Sgt. R. Graham; Sgt. R. Hindmarch; P/O. L. O. Noll; Sgt. D. E. Owen; F/O. G. S. M. Pearson; Act. Flt. Lt. D. A. Routen, D.F.M.; Sgt. K. G. Sewell; Sgt. F. G. Scarr; Flt. Sgt. J. T. Simpson; Flt. Sgt. W. E. A. Spencer; Sgt. R. Sykes; P/O. C. Wolstenholme; Flt. Sgt. G. Woodcock.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. G. E. Agate; Sgt. J. A. Bacon; Sgt. J. D. Bates; Flt. Sgt. M. Baxter; P/O. G. A. Berwick; Flt. Sgt. D. J. Bigham; F/O. R. T. J. Bilney; F/O. J. W. H. Brown, D.F.M.; Sgt. A. C. Brunton; Sgt. H. E. Buckman; Sgt. N. E. Burgess; F/O. H. Burke, D.F.M.; Sgt. R. E. Chapman; Sgt. G. Cheadle; Sgt. A. Clarke; Sgt. D. J. Collins; Sgt. N. P. Collins; Sgt. C. J. Cooper; P/O. E. R. I. Cornell; Sgt. D. G. Cox; Sgt. W. M. Crosbie; Flt. Sgt. R. Crossley; Sgt. J. R. Culshaw; Sgt. F. C. Daniels; Sgt. E. Darbyshire; Flt. Lt. H. W. J. Dare; F/O. J. T. Davidson; Flt. Sgt. A. Davie; Sgt. D. Deans; Sgt. P. F. Dewdney; Sgt. E. C. Dixon; P/O. J. Fletcher; F/O. B. J. Fox; Sgt. W. S. Frame; Flt. Sgt. A. E. Fuller, D.F.M.; Flt. Sgt. E. Gorbert; Sgt. W. McK. Grant; Sgt. J. J. Gratton; Sgt T. A. Hallam; Sgt. E. C. Harris; Sgt. L. Hobson; Sgt. O. H. Hodges; P/O. S. G. Holman; Sgt. D. Hopkins; Sgt. J. T. Hubbard; Sgt. N. Hugill; Sgt. W. Hutchinson; Sgt. H. Jennings; Sgt. B. E. H. Kirkman; Sgt. H. W. Lilley; Flt. Sgt. A. C. Ludgater; Sgt. J. McAdam; Sgt. S. J. MacEllenborough; Sgt. S. J. Marks; Sgt. E. Middleton; Sgt. R. H. Nash; Sgt. K. Pearson; Sgt. N. Pendlebury; F/O. D. W. Philip; Sgt. D. P. J. Rawlings; Sgt. R. Renfrew; Sgt. J. H. Richards; P/O. K. C. Rigby; Sgt. J. H. Shaw; Flt. Sgt. R. G. Shaw; P/O. H. W. Shinn; Sgt. J. R. Shone; Sgt. H. G. Shoobert; Sgt. W. Simpson; Sgt. A. J. K. Steven; Sgt. L. L. Stone; Sgt. C. E. Taylor; Sgt. D. A. Thomas; Sgt. J. C. Thomson; Sgt. B. F. Trew; W/O. D. A. Tucker; F/O. S. R. Vivian; Sgt. E. G. Westall; P/O. J. M. Young.

FOR BEER : The long-range tank of a Spitfire IX being filled with beer before delivery to our troops in France.

WOUNDED OR INJURED IN ACTION.—Sgt. R. D. Chandler; Sgt. D. A. Gray; F/O. R. H. Tredwin; Flt. Sgt. C. W. Way.
MISSING, BELIEVED KILLED IN ACTION.—P/O. H. H. Adams; P/O. E. F. Crossley; Sgt. W. D. Kinnes; P/O. H. R. Pizzey; Sgt. J. S. Richards.
MISSING.—P/O. P. R. Aslett; Flt. Sgt., H. Aspinall, D.F.M.; Flt. Sgt. E. Bailey; Flt. Sgt. F. W. Barnett; Sgt. R. D. P. Barrett; Flt. Sgt. F. J. Bell; Flt. Lt. T. H. Blackham, D.F.C.; F/O. F. J. Blute, D.F.M.; Sgt. S. Bosworth; Flt. Sgt. J. W. Bott; Sgt. A. G. Buttling; P/O. R. E. Chantler; Sgt. R. J. Clarke; F/O. S. M. Clarke; Sgt. D. J. Coldicott; P/O. H. B. Cooper; Flt. Sgt. P. M. Constable; Sgt. S. W. Courtenay; Sgt. J. Crichton; Flt. Sgt. W. Cully; Sgt. J. C. Cummings; Sgt. J. Davidson; Sgt. C. C. Davies; Sgt. W. D. Dixon; F/O. D. McM. Drew; Flt. Sgt. J. C. Earl, D.F.M.; Sgt. J. G. Eastman; Sgt. A. Farmer; Sgt. E. Farmer; Sgt. H. T. G. Flint; Act. Flt. Lt. R. J. Freeman; Sgt. W. T. Freeman; F/O. S. M. Garlick; Flt. Sgt. R. V. George; Flt. Lt. J. Gillies, D.F.M.; Sgt. G. Goddard; P/O. S. Godfrey; Sgt. R. J. Gracey; F/O. R. F. M. Hacker; F/O. A. H. Hall; Sgt. W. Harbour; P/O. J. D. Harrison; Flt. Sgt. J. Harvey; Flt. Sgt. J. Healy; P/O. R. H. P. Hollander; Flt. Sgt. T. Horton; Flt. Sgt. E. G. Housden; Sgt. C. A. Howson; P/O. D. Hughes; Flt. Lt. W. E. Hull, D.F.C.; Sgt. E. J. Hurr; Sgt. F. W. Ingham; Flt. Lt. J. H. Inns; Sgt. C. A. James; F/O. D. G. Jones; Sgt. G. R. Jones; Flt. Sgt. J. J. Jones; Sgt. T. E. Jones; Sgt. B. Kenrick; Sgt. R. D. Loke; Sgt. R. MacBeth; F/O. D. W. Magan; Flt. Sgt. A. Matthews; F/O. P. G. Maxwell; Flt. Sgt. E. A. Metcalfe; Sgt. J. Morgan; Sqn. Ldr. A. O'S. Murdoch; Sgt. D. P. Nash; Sgt. F. D. Nash; P/O. L. F. G. Noakes; Sgt. R. W. Norris; Flt. Sgt. H. F. O'Hara; Sgt. K. W. Owen; F/O. A. J. Painter; Sgt. J. Palfrey; Sgt. N. Pearce; Sgt. K. Pearton; Sgt. S. J. W. Poulson; Sgt. R. S. Pountney, Sgt. D. Prewer; Sgt. V. B. Prime; F/O. J. H. Pullman; Sgt. A. R. Redfearn; P/O. C. Reed; Sgt. H. G. Rudd; W/O. H. T. Rolph; Flt. Sgt. W. H. Rumnes; Sgt. J. H. Sallis; Sgt. J. Y. Scott; Sgt. L. A. Scott; Sgt. W. G. Singfield; Sgt. H. Skellorn; Sgt. R. S. Smith; Sgt. P. A. Staniland; Sgt. J. L. Stean; Flt. Sgt. E. A. Stone; Sgt. C. H. Thompson; F/O. G. C. Tincler; P/O. J. W. Tonkyn; Sgt. A. E. J. Townsend; P/O. J. B. Tweedie; Sgt. E. Usher; P/O. C. R. E. Walton; Flt. Sgt. J. B. Ward; Sgt. T. D. Ward; Sgt. K. R. J. Warren; Sgt. R. Watson; Sgt. P. J. Weaver; F/O. W. H. Widger, D.F.M.; Flt. Sgt. E. Wilde; Sgt. S. C. Wilkins; F/O. R. D. Wilson, D.F.M.; Sgt. W. Wilson; Sgt. C. G. Woplin.
KILLED ON ACTIVE SERVICE.—Sgt. L. Allen; F/O. J. A. Bailie; Flt. Sgt. J. Baker; Sgt. N. G. Calles; Sgt. J. G. Case; Sgt. A. V. Chandler; Sgt. T. Ellams; Flt. Sgt. L. J. Friend; Cpl. G. A. Hall; Sgt. K. G. F. Harvey; Flt. Lt. T. W. Irwin; P/O. G. R. Jeans; Sgt. A. J. G. King; Sgt. A. Kingsland; F/O. J. E. Mathias; Sgt. V. J. Mudge; Sgt. A. W. Norris; Sgt. H. Rimmer; Sgt. W. L. Scott; Sgt. R. V. Searle; Sgt. A. W. Sherry; Sgt. A. D. Short; Sgt. J. W. Sigsworth; Sgt. T. Spensley; Sgt. T. H. Stacey; P/O. J. M. Talbot; P/O. T. S. Wardlow; Sgt. J. W. Willies.
PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. W. K. Witham.
WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. H. Rutter.
DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. E. J. J. Sente.
DIED ON ACTIVE SERVICE.—L.A/C. E. J. Bailey; L.A/C. J. Clay; A/C.1 A. E. Connor; A/C.1 C. W. A. Daniels; Cpl. L. J. Maynard; Cpl. W. Swinburne.
PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. A. G. Ryder; Flt. Sgt. I. T. Taylor; Sqn. Ldr. R. E. Young, D.F.C.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. E. M. Adams; S/O. K. Vandyck.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. L. H. Hibbins.
MISSING, BELIEVED KILLED IN ACTION.—P/O. R. F. Culliford; P/O. A. E. Oberg.
MISSING.—P/O. G. J. Atwell; F/O. A. P. Bowman; F/O. L. W. Bown; P/O. W. N. W. Brown; P/O. C. Dickson; Ft. Sgt. R. V. Donows; W/O. A. J. Farrar; Flt. Sgt. B. H. Forden; F/O. G. Fryer; Flt. Sgt. O. S. Furniss; Flt. Sgt. R. I. Hunter; Flt. Sgt. S. D. Jolly; W/O. J. Leary; Flt. Sgt. H. G. McAlister; Flt. Lt. K. M. Napier; Flt. Sgt. A. R. Patterson; P/O. S. L. Rowe; P/O. G. A. Skinner; P/O. C. E. Stephenson; Flt. Sgt. R. T. Walker; Flt. Lt. D. W. Wickes; F/O. H. E. Williams.
KILLED ON ACTIVE SERVICE.—F/O. J. M. Cronin; F/O. J. J. Owen; F/O. S. W. L. Richins.

Royal Canadian Air Force

MISSING, BELIEVED KILLED IN ACTION.—Sgt. V. A. Knox; F/O. J. H. Wilson.
MISSING.—P/O. E. L. Alberts; F/O. B. B. Ashley; P/O. G. R. Berkey; W/O. H. G. Boissevain; W/O. J. A. Bourgeault; W/O. N. W. E. Burdett; Sgt. R. H. Cameron; Flt. Sgt. C. A. Campbell; W/O. W. G. Dennstedt; W/O. R. L. Francis; Flt. Lt. H. C. C. Goodyear; Sgt. W. L. Granbois; P/O. J. Grodecki; F/O. M. S. Gurski; Flt. Sgt. R. N. Kirkpatrick; Flt. Sgt. R. P. Lindsay; Flt. Sgt. D. F. Malyon; F/O. P. G. Milburn; F/O. J. A. Negl; W/O. W. R. Oliver; Flt. Sgt. J. M. Ronahan; P/O. R. A. Saltzberry; F/O. P. A. Schnobb; Sgt. H. C. Seedhouse; Flt. Sgt. I. A. Weir.
KILLED ON ACTIVE SERVICE.—F/O. T. E. Chmielowiec; Sgt. F. R. Dawson; Flt. Sgt. C. C.

SERVICE AVIATION

Haynes; P/O. H. M. R. Herbert; Sgt. A. L. Lunan; Sgt. J. T. McGovern; Sgt. H. G. Thompson.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. E. H. Hyde; P/O. P. J. Weber.

DIED ON ACTIVE SERVICE.—L.A/C. F. Dickinson.

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Sgt. J. M. MacLeod

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. G. Baker; F/O. E. W. M. Jacombs; Flt. Sgt. K. A. McGregor; P/O. D. H. Moss; Flt. Sgt. S. O. O. Reeves; F/O. N. W. Springer.

MISSING.—Flt. Sgt. J. G. Hudson

KILLED ON ACTIVE SERVICE.—Flt. Sgt. S. E. Telfer.

South African Air Force

KILLED ON ACTIVE SERVICE.—2/Lt. J. S. De Klerk; 2/Lt. A. C. Holmes; Lt. P. J. Kilian; 2/Lt. D. M. Lloyd; Flt. Sgt. T. A. Selley; Lt. C. C. Vanderspuy.

Casualty Communique No. 408

Of the names in this list 100 are second entries giving later information of casualties published in earlier lists

Royal Air Force

KILLED IN ACTION.—Sgt. G. Aldridge; Sgt. R. H. Birch; Air Comdre. Viscount G. L. S. Carlow; P/O. W. J. Crawford; P/O. G. R. Davis; F/O. A. G. T. Gardiner; F/O. A. R. Hamlin; Sgt. E. A. J. Healey; Flt. Sgt. W. H. Higgins; Sgt. R. T. Holbrook; Sgt. J. E. Hutchinson; P/O. G. W. Lamb; Flt. Sgt. G. V. Mackew; F/O. N. S. Nicklin; Act. Sqn. Ldr. J. F. Percival; Flt. Sgt. T. Ramage; Flt. Sgt. M. K. Rowe; Sgt. K. Rusby; Flt. Lt. J. R. Savage; Sgt. T. Shehan; Sqn. Ldr. W. G. Tiley; Sgt. A. A. Whittome; F/O. K. B. Winfield; Flt. Sgt. E. J. Winters.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. R. E. Ault; F/O. V. G. Deacon; Sgt. I. K. Doncaster; Act. Flt. Lt. C. N. Hammond; P/O. E. E. Jones; Sgt. G. C. Robinson; F/O. B. H. Steele; F/O. J. J. S. Townsend, B.E.M.; Sgt. W. Turnbull.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. N. Angus; Sgt. W. F. Ardron; Sgt. W. J. Barriskill; Flt. Sgt. H. J. Beake; Sgt. W. R. Black; F/O. S. C. H. Bone; Sgt. K. F. Bristow; Sgt. R. J. Broad; Sgt. R. B. Bull; Sgt. A. W. S. Bundy; P/O. R. McM. Campbell; Sgt. R. F. Carpenter; Sgt. D. E. Dalton; Sgt. S. E. Davies; Sgt. L. V. Dean; Sgt. O. A. H. Dixon; Sgt. F. E. Dudley; F/O. I. S. Dunbar; W/O. O. Fielden; Sgt. W. Garner; P/O. J. H. Gielstrup; P/O. J. C. Giles; F/O. W. W. Goldberg; Sgt. J. Graham; Sgt. D. Griffiths; Sgt. K. Hall; Sgt. W. J. Hargreaves; Sgt. S. F. Hillman; Sgt. G. S. Holloway; Sgt. F. G. Holmes; Sgt. S. H. Hopkins; Sgt. R. W. L. Houghton; Sgt. C. F. Hudson; F/O. F. H. Jenkins; Sgt. C. E. Joel; F/O. J. Jones; Sgt. R. H. Jones; Sgt. J. K. Kirk; F/O. R. T. E. Latham; F/O. A. C. Lee; Sgt. W. J. Lee; Sgt. J. W. Lunn; F/O. R. Lyon; Sgt. P. W. S. McCartney; Flt. Sgt. S. McCormick; Sgt. G. W. MacKenzie; Sgt. K. H. G. McLennan; Sgt. F. D. Mason; Sgt. J. Mullin; F/O. E. H. Ottway; Sgt. J. P. Padley; Flt. Sgt. C. J. Peters; F/O. L. G. Popperwell; Sgt. J. R. Portsmouth; Sgt. A. A. Poulton; F/O. E. A. Povey; Sgt. R. B. Pownall; F/O. R. G. Rainford; P/O. J. R. F. Ratcliffe; Sgt. B. Robinson; Sgt. E. Saunders; Sgt. W. H. Saunders; Sgt. H. J. Shaw; Sgt. H. A. Sparrow; Act. Flt. Lt. S. W. Taylor; P/O. A. H. Thompson; Sgt. G. Thompson; Sgt. J. G. Watkins; Sgt. F. Watling; F/O. G. W. Webster; Sgt. W. M. Welsh; Sgt. W. H. Wheatley.

WOUNDED OR INJURED IN ACTION.—Sgt. J. W. Carrigan; Sgt. F. Nicholls; Sgt. J. K. Thomson

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. L. B. Little; P/O. A. Shaw.

MISSING, BELIEVED KILLED IN ACTION.—F/O. P. M. Berry; Sgt. J. W. Dunford; Sgt. R. D. Frame; Sgt. T. H. B. Griffiths; Sgt. J. Kempson; Sgt. G. W. Whittles.

MISSING.—Sgt. F. I. Anderson; Sgt. J. Atkinson; Sgt. J. Bailey; Sgt. S. J. Barr; F/O. E. Bashi; P/O. W. J. Bell; Sgt. N. R. Bishop; Act. Sqn. Ldr. K. F. P. Bond; Sgt. E. E. Borton; Sgt. A. J. Bowles; F/O. I. M. Briscoe; Flt. Sgt. G. H. Brown; F/O. H. E. V. Budge; Flt. Sgt. F. Burgess; Sgt. J. Casey; Flt. Sgt. J. W. Chapman; Sgt. G. Cranston; Flt. Sgt. G. E. Creer; Flt. Lt. A. Dalrymple; Flt. Lt. A. W. B. Davies; Act. Group Capt. E. C. Eaton, D.F.C.; Sgt. W. L. Evans; P/O. N. J. Fisher; Sgt. E. Forshaw; P/O. P. H. French; Act. Sqn. Ldr. L. H. Glasspool, D.F.C.; Sgt. R. F. Godfrey; Act. Flt. Lt. L. D. Goldingay, D.F.C.; P/O. J. J. Gorman; Sgt. P. F. Gough; L.A/C. F. W. Guest; F/O. O. H. M. Hall; Flt. Sgt. J. L. Harden; Sgt. N. Hatton; Sgt. R. H. Haynes; Sgt. A. G. Haywood; Sgt. L. Jakeman; Sgt. J. E. Johnson; Sgt. A. T. G. Jones; F/O. H. J. Kadwill; Flt. Sgt. K. S. Keeping; Flt. Lt. C. A. Kidd; Flt. Sgt. N. A. Lacey-Johnson; F/O. K. T. Larman; Act. Flt. Lt. R. A. M. Lemmon; Flt. Sgt. J. D. Lewis; Sgt. A. R. Line; Act. Wing Cdr. W. G. Lockhart, D.S.O., D.F.C.; Sgt. J. McCool; Flt. Sgt. J. A. McKerrow; Sgt. J. Marsden; Act. Sqn. Ldr. J. L. Martin, D.F.C.; F/O. M. A. Mason; Sgt. S. Mason; Flt. Sgt. W. S. Millar; Sgt. W. Milner; Sgt. P. P. J. E. Moxey; F/O. K. W. A. Muir; Sgt. R. Nicholls; F/O. G. W. Oldham, D.F.C.; Act. Flt. Lt. H. T. Petts, D.F.C.; F/O. L. W. Petts; Sgt. H. Pickford; Sgt. H. E. Pollard; Flt. Sgt. F. J. W. Quinn; Sgt. J. W. Randall; Flt. Sgt. N. P. Reilly; Sgt. S. Rennie; Sgt. V. R. Roper; Act. Sqn. Ldr. G. Ryle, D.F.C.; F/O. R. G. Sharland, D.F.C.; Sgt. F. W. Shields; Sgt. D. J. Skeites; Sgt. E. G. Sneyd; F/O. T. H. Speller; Sgt. H. Steels; Sgt. R. Thompson; Sgt. C. Van De Velde; F/O. P. Wadsworth; Sgt. J. Waites; Sgt. F. B. Walker; Flt. Sgt. J. D. Ward; P/O. A. Warren; P/O. R. Whalley; P/O. C. J. Wheelhouse; F/O. R. H. Wilkinson; Sgt. W. F. Williams; Sgt. J. G. Woods; Flt. Sgt. D. Yuille.

KILLED ON ACTIVE SERVICE.—Sgt. R. G. Aspinall; L.A/C. A. S. Ball; Sgt. S. Bird; Sgt. T. H. Burman; F/O. S. J. Chaplin; Sgt. R. J. Clayton; Sgt. J. T. Cook; F/O. A. Duncan-Smith; F/O. A. H. Eastment; Sgt. F. W. Edwards; Cpl. D. R. Evans; Sgt. A. Goddard; Sgt. V. C. W. A. Gouldstone; Sgt. W. M. Harvey; P/O. A. W. J. Hazell, D.F.M.; Sgt. H. E. Herbert; Sgt. K. D. Holden; F/O. P. W. R. Holes; F/O. D. W. McRuer; Sgt. R. S. Ogg; P/O. C. J. B. Phillips; Sgt. H. G. C. Powell; F/O. T. D. Reilly; Sgt. J. N. Robertson; F/O. R. V. Spencer; F/O. G. Stark-Toller; A/C.2 S. Stokoe; Sgt. H. J. Street; Flt. Sgt. T. B. Willard.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. J. Dale; L.A/C. A. R. V. Hudson; Sgt. W. Newton.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. Trotter.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. W. Aston; W/O. P. Bond, D.F.M.; Sqn. Ldr. R. H. Burdon-Cooper; Flt. Sgt. R. D. Codlin; Sgt. W. R. Field; Sgt. L. G. Garrod; Flt. Sgt. P. Holt, D.F.M.; Flt. Sgt. H. N. Iggulden; Sgt. F. H. Rout; Flt. Lt. K. G. S. Smith; L.A/C. A. W. Taylor

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—F/O. R. Gorton; P/O. R. N. Hilsden; Sgt. C. V. Lake; F/O. D. A. McKellar.

DIED ON ACTIVE SERVICE.—Sgt. R. Allen; A/C.1 A. Amey; Flt. Sgt. F. P. Aspin; Flt. Sgt. C. Davies; Sgt. A. C. Gillard; Sgt. H. Humphries; L.A/C. L. G. Lyford; Cpl. F. E. Mouncer; A/C.2 M. J. O'Connor; A/C.1 G. R. Sampson; A/C.2 J. Sideserf; L.A/C. G. A. White.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. W. M. Beauchamp; Flt. Sgt. F. S. Brissenden, F/O. J. P. Diversi; Flt. Lt. G. C. Keys, D.F.C.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. R. D. Elrington.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. C. H. Kohler.

MISSING.—F/O. L. J. Calderwood; Act. Flt. Lt. J. R. Dodds; P/O. G. T. Harrison; P/O. I. W. Hunter; Flt. Sgt. D. J. McDonald; Flt. Sgt. G. W. McLean; F/O. C. C. Schomberg; Flt. Sgt. R. W. Watson.

KILLED ON ACTIVE SERVICE.—P/O. P. W. Laidler; W/O. R. M. McCrabb.

WOUNDED OR INJURED ON ACTIVE SERVICE.—P/O. S. M. Morris.

DIED ON ACTIVE SERVICE.—Flt. Sgt. E. M. Jensen.

SEARCHLIGHT SILHOUETTE: A Mosquito and a R.A.F. Regiment guard silhouetted by a searchlight on an advanced T.A.F. station.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. H. C. Austen; W/O. M. Wishak.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. J. P. M. Bedard; F/O. A. D. Gavel; Flt. Sgt. D. C. MacDougall; W/O. H. C. Wilson.

MISSING.—F/O. H. J. Brennan; F/O. G. C. Burns; F/O. R. J. Crossfield; Sgt. J. P. L. W. L. Desroches; Sgt. R. J. Dickson; Sgt. C. D. Duncan; Sgt. A. Elder; Flt. Lt. G. A. Holland; P/O. A. S. F. Holmes; Sgt. I. H. R. Hortie; P/O. A. J. Houston; W/O. A. Hutton; P/O. R. G. Leonard; F/O. N. R. McGregor; W/O. B. J. MacKinnon; Flt. Lt. G. R. Morgan; W/O. J. M. Power; W/O. D. K. Schroder; F/O. E. T. Tinker; Sgt. J. E. Trotter.

KILLED ON ACTIVE SERVICE.—Sgt. L. J. Cull; Sgt. K. French; W/O. J. K. Gillies; F/O. D. R. Holloway; W/O. J. Huddleston; F/O. S. W. Jobson; Sgt. C. E. Lovett; Sgt. H. L. Musiner; F/O. H. H. Richardson, D.F.M.; F/O. A. C. MacD. Rolph; F/O. J. H. Smith; W/O. R. E. Stewart; F/O. H. A. Wallace.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. R. L. Holmgren; F/O. I. L. McLean; F/O. G. Mann.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. C. G. Baker; Flt. Sgt. A. K. Baxter; Flt. Sgt. C. J. Bridger; Flt. Sgt. C. G. Hamilton; Flt. Sgt. D. L. C. Haub; Flt. Sgt. F. D. Higham; F/O. W. J. Hoy; Flt. Sgt. K. C. Jackson; W/O. W. C. Jorgensen; Flt. Sgt. F. P. Lundon; W/O. A. S. Roberts; Flt. Sgt. E. J. Roberts; P/O. S. T. Schmidt; Flt. Sgt. J. L. Talbot.

WOUNDED OR INJURED IN ACTION.—W/O. J. W. Haugh.

MISSING, BELIEVED KILLED IN ACTION.—F/O. L. J. S. Fittock.

MISSING.—F/O. K. G. Franklin; Flt. Sgt. M. M. Hamilton; P/O. A. P. Jenkins; P/O. G. J. Mee; F/O. J. S. Thomson.

South African Air Force

KILLED IN ACTION.—2/Lt. K. Shaw.

Air Transport Auxiliary

Flt. Capt. ELEANOR ISABELLA SLADE, A.T.A., killed whilst ferrying His Majesty's aircraft in England.